FOUNDRY TRADE JOURNAL

EST. 1902

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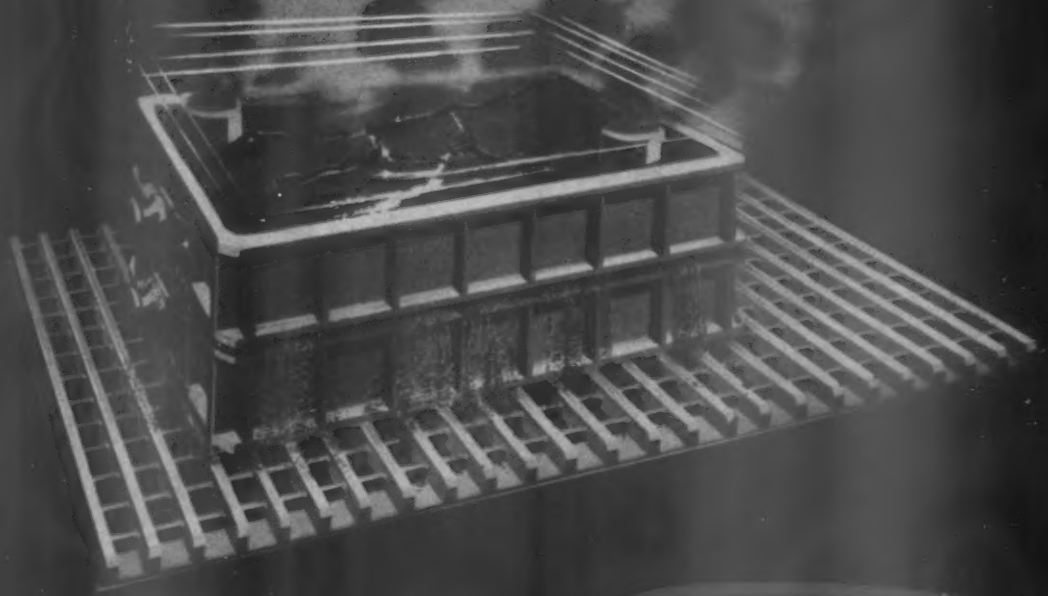

Sterling

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AND SHAKE-OUT MACHINES

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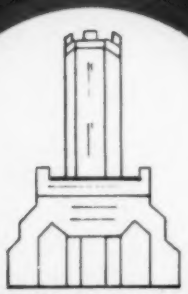
"Darwen Brand"



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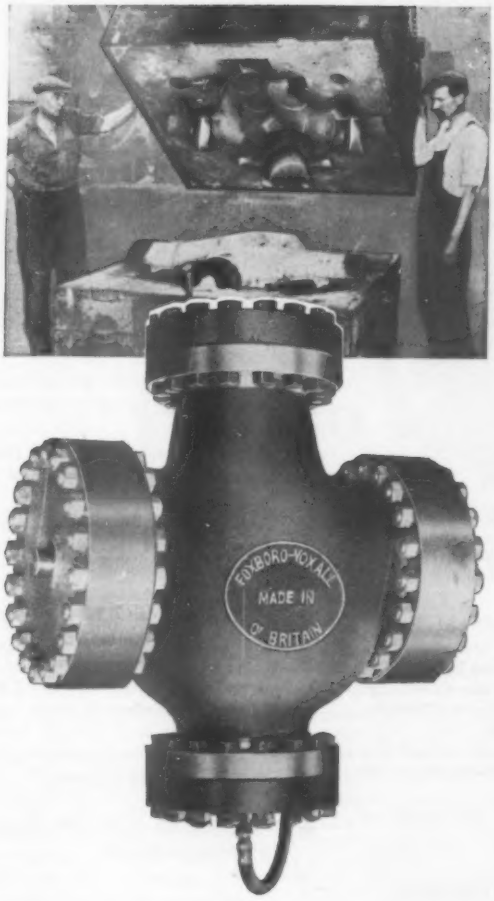
Spermolin CORE OILS AND BINDERS

For every type of casting



Carbon steel valve casting, weight 3 tons, tested under pressure at 2,000 lbs per sq. in., for oil-installation. Photo of core and casting by courtesy of Messrs Lake & Elliot, Ltd., Iron and Steel Founders, Braintree, Essex.

★ CORE OILS
★ COLD SETTING OILS
★ CORE CREAMS
★ SEMI-SOLIDS
★ CO_2 BINDERS
★ CEREAL BINDERS
★ MIXING & CORE MACHINES

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THE HALLMARK OF QUALITY

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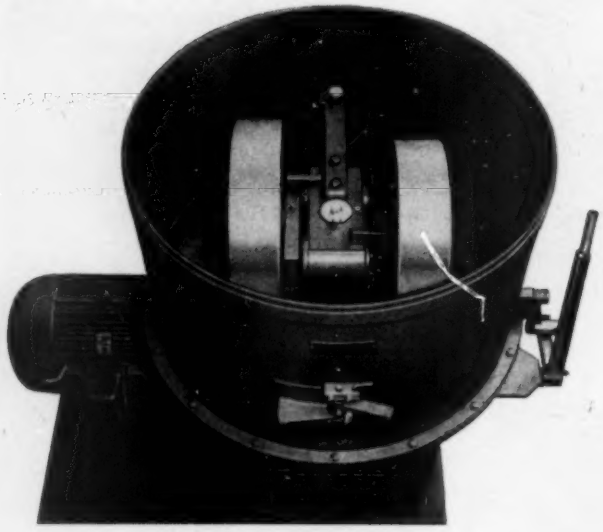
SPERMOLIN LIMITED, UNION STREET SOUTH, HALIFAX, ENGLAND. Tel: 4197.

A

FOUMEC

42" dia Batch Type Sand Mill.

PLANTS



This Foumec 42in. Sand Mill is exceedingly versatile and ideal for varied and small requirements.

As a facing Sand Mill, for sands of an average bond strength, its capacity is approximately 3 cwts. per batch. Due to its high efficiency, and at a rate of 12/15 batches per hour, its output for facing sand can be approximately 2 tons per hour.

As a mixer for core sand with a low green bond strength the batch can be raised to 4 cwts. At 12/15 batches per hour this will give approximately 3 tons per hour.

Further details are yours for the asking, why not contact us today.

Interesting features.

- ★ Mullers mounted on ball bearings. They are connected to the centre pivot by a lever arm which allows them to rise or fall to suit the depth of sand in the pan.
- ★ Sand Mill, vertical gear and motor assembly, all on one base plate.
- ★ Device provided for taking sand sample without danger whilst in operation.
- ★ Stops are provided to prevent the mullers bearing on the pan when the latter is empty.
- ★ Single or double evacuation door, hand or pneumatically operated.
- ★ All internal parts efficiently protected against sand infiltration.
- ★ Centre pivot mounted on upper and lower taper roller bearings.
- ★ Provision of a replaceable pan bottom wearing plate and also ring.
- ★ Top orientable cover with hinged portion for loading materials.

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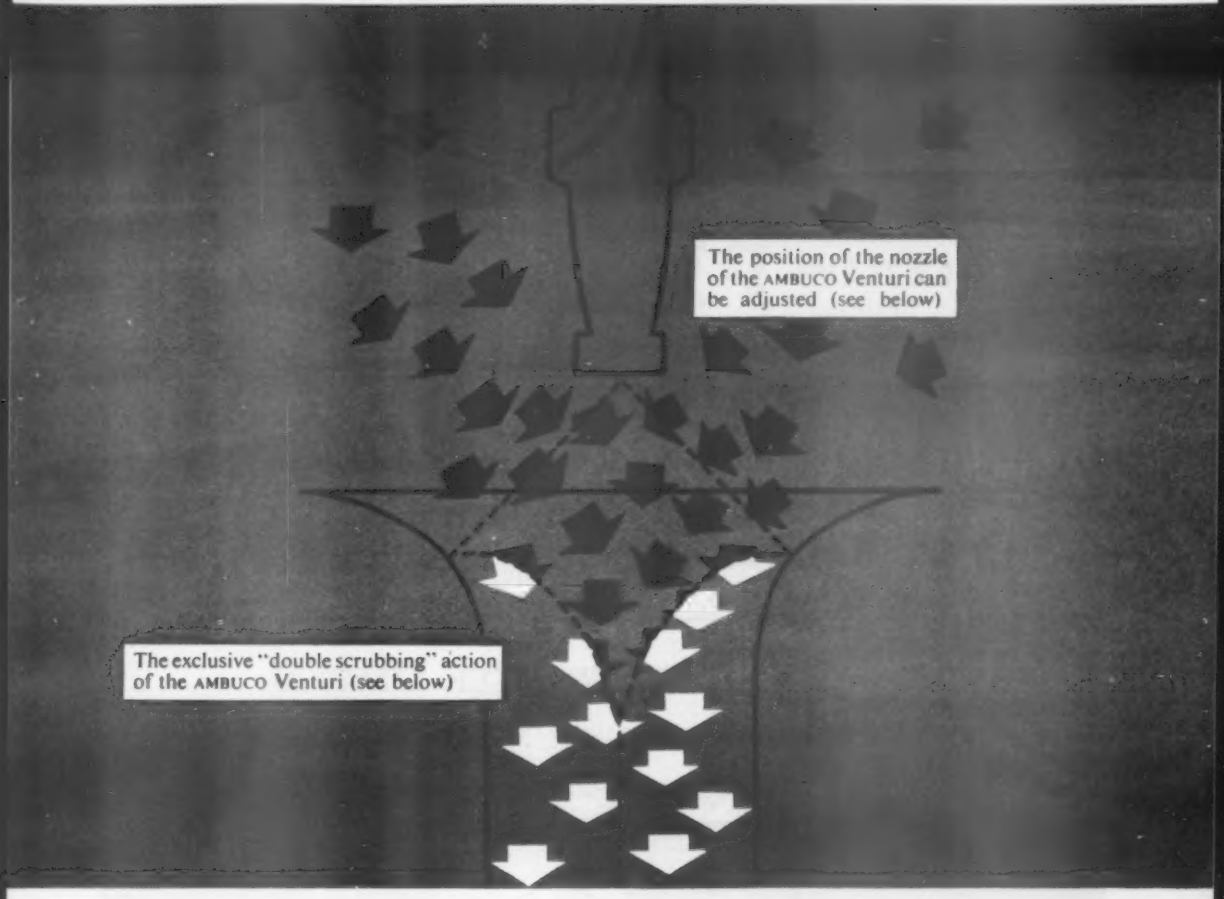
Tel: BLETCHLEY 3354 *Regd. Office* 29, CROMWELL ROAD, LONDON, S.W.7. *Grams:* "FOUMEC" BLETCHLEY


The position of the nozzle of the AMBUCO Venturi can be adjusted (see below)
The exclusive "double scrubbing" action of the AMBUCO Venturi (see below)

How to stop smoking

Ambuco Venturi Scrubbers remove industrial smoke more efficiently because . . . .

. . . . . **the exclusive "double scrubbing" action** (Waagner Biro System) of the Ambuco Venturi forces the dust-laden gases to pass through *two* complete cones of water. In the first cone the water droplets are relatively large and travel fast. In the second cone the water droplets are relatively small and travel more slowly, while the speed of the gas and the dust-laden particles increases. The resulting maximum relative velocity ensures highest collection efficiency.

. . . . . **the position of the nozzle** can be varied to control the size of the droplets, giving optimum removal of particles of a given size.

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Efficiencies equivalent to 99.8% removal of the entrained solids and dust densities as low as 0.03 gr/c.ft. in the cleaned gas are obtained, for example:

Iron Blast Furnace dust	99.2%
Oxysteel Converter dust	99.8%
Copper Reduction Furnace dust	99.8%
Electric Steel Smelting Furnace dust	98.0%
Ferro Silicon dust	92.0%

Dust control is our sole concern and our design and engineering service is fully equipped to deal with all dust control and recovery problems employing scrubbers, cyclones, grit arresters, fabric dust collectors and other equipment.

You can see working models of the Ambuco Venturi Scrubber and the Ambuco "guaranteed efficiency" Cyclone at the HEVAC Exhibition at Olympia 26th Sept. to 6th Oct.

For technical literature on Ambuco Venturi Scrubbers please write to AMBUCO Ltd., Standbrook House, 2/5 Old Bond Street, London, W.1. or ring HYDe Park 2178.

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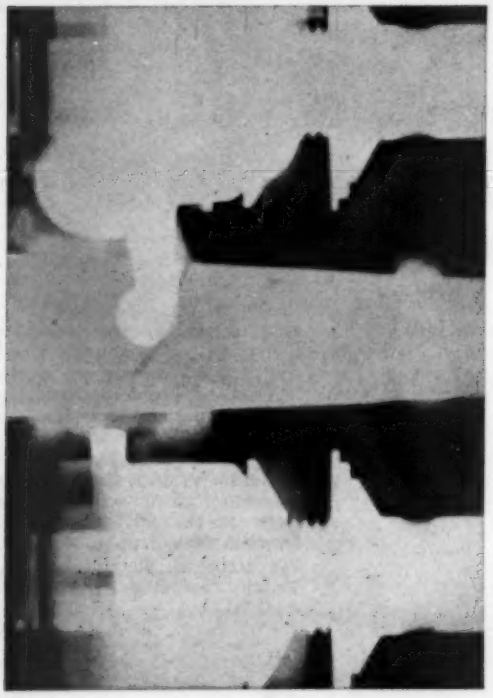
Telephone : Rotherham 4033 *ESTABLISHED 1831* *Telegrams : " Walkers, Rotherham "*



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NON-DESTRUCTIVE
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The comprehensive service available from Palmer, supported by a Welding advisory service, is available to the foundry man, sheet metal and plastic fabricator, nuclear engineer, indeed everyone to whom certainty of soundness is essential.

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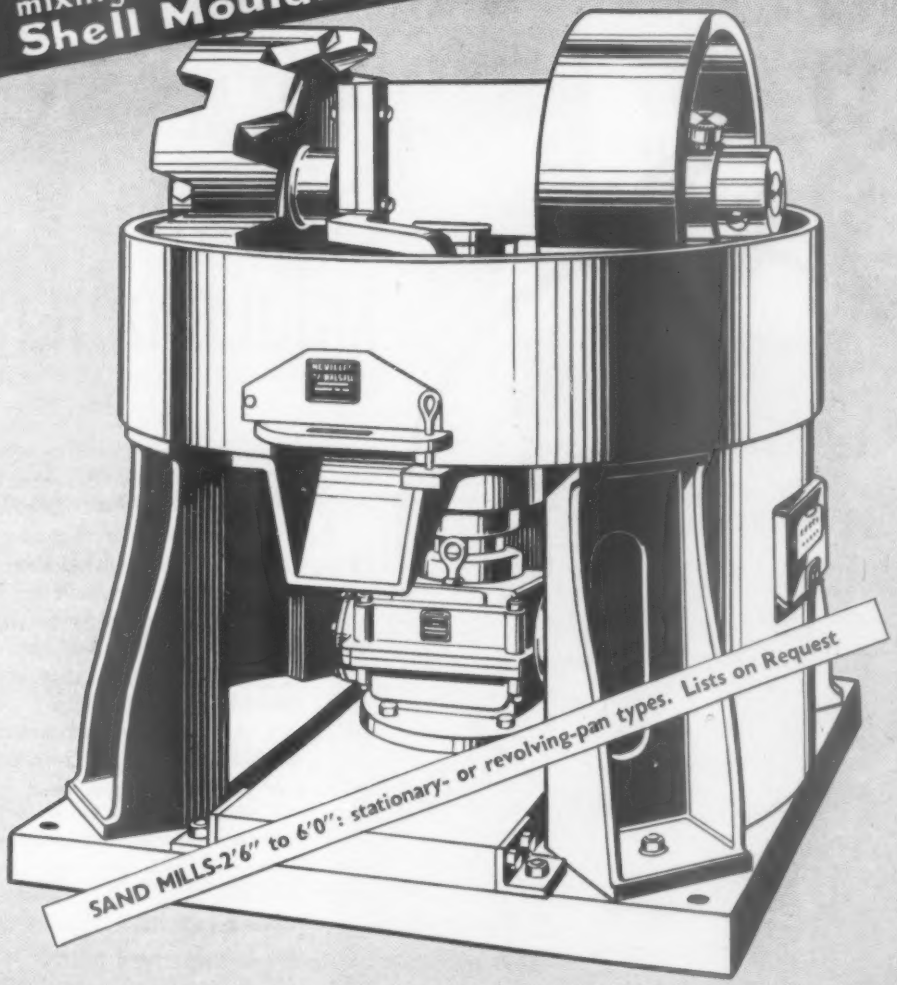
the approved method of mixing coated sand for **Shell Moulding**

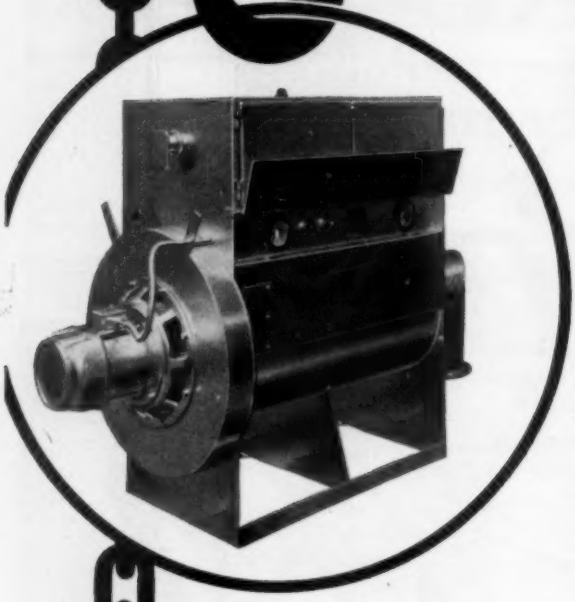


Nevilles of **WALSALL**

T.C.NEVILLE & SONS LTD HATHERTON STREET FOUNDRY, WALSALL.

BROWN BOVERI

PORTABLE ELECTRIC MOULD DRIERS



. . . designed for drying floor moulds or large box moulds for ferrous and non-ferrous metal castings. They operate by forcing hot air over the mould surface and through the sand giving quicker and more efficient drying than is normally achieved by other methods. Using air temperatures lower than hot gases, and less than one third the quantity of heat, they reduce drying times by half. Heating is uniform throughout the mould and despite rapid drying, surfaces remain free from cracks and cleaner castings are produced.

* Driers need no attention during operation.
* Power input is regulated automatically.
* Working conditions are improved by elimination of smoke and burning gases.

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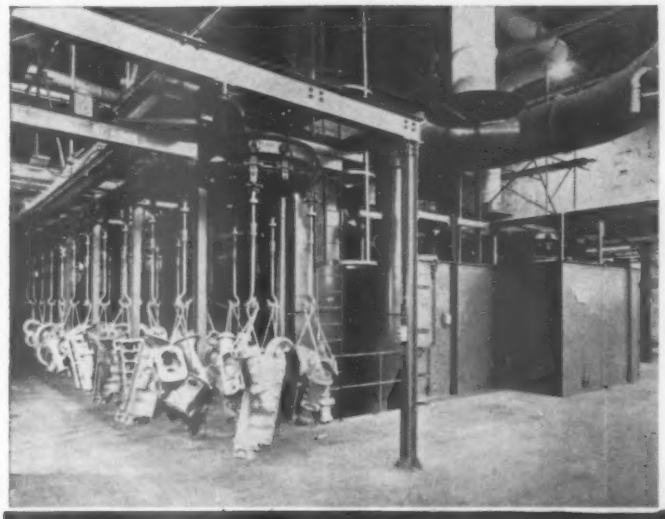

OVERHEAD MONORAIL CONVEYOR ABRASIVE CLEANING PLANTS

One of two Overhead Monorail Conveyor plants installed in the foundry at the Ford Motor Co. Ltd., Dagenham, for cleaning tractor and commercial components. The machine is equipped with six centrifugal blast units, which give complete cleaning coverage to the heavily loaded conveyor hangers passing through the cabinet.

DUAL TABLE WHEELABRATOR PLANTS

The machine illustrated has two 9 ft. diameter tables, and is installed in the steel foundry of the English Steel Corporation Ltd., Sheffield. In this instance, production has been doubled and the handling halved, compared with the cleaning method used previously.

TILGHMAN'S LTD.

STAVELEY SG GROUP

BROADHEATH, ALTRINCHAM, CHESHIRE

Tayson T507

"Pop . . . there's some customer on the blower wanting to know why Sternocore Oil A is in such demand!"

"CUSTOMER! Here, give me that 'phone. Haven't I told you before, boy, customers are our life-blood.

Clearing his throat and standing to attention, our Oldest Hand then spake with olde-worlde courtesy to our client, to summarise as follows:—

STERNOL **Sternocore Oil A**

- Is a time tested prime quality core oil.
- Gives cores ar excellent skin finish.
- Has unusual tolerance to over baking.
- Is "at home" in both mechanised and jobbing foundries.
- Gives peak dry tensiles at even ¼%.
- Has minimum gas evolution.

N.B. For further information please ask our Foundry Department for process sheet FPS/4.

STERNOL LIMITED · ROYAL LONDON HOUSE · FINSBURY SQUARE · LONDON, E.C.2. · TEL: MON 3871/5

A tale of seven cats...

CATALAC (alas)

What a caterwaul! There's no need to cry over spilt milk (or money). Just wipe up the tears and use Catalac in future. Catalac is a Cat-o-many-tails, each one saving you time and money. Catalac core and mould sprays and paints can be flame or air set. These Cats give you a clean, smooth, almost purrrfect finish with a clean strip. Foundry managers find that this kind of Cat keeps fettling right down to a minimum. It's time you became a Cat fancier too.

SIX MORE CATS FROM CATALIN

CATASET is an Air Setting Resin Binder, primarily used as a mould facing backed up with regular moulding sand. This Cat produces exceptionally fine castings at very low cost.

CATACORE the specialised quick-baking binder. Here's a Cat that makes a core that makes foundry managers purr with satisfaction because it gives them faster, smoother, cheaper cores.

CATAMOLD is a range of powdered Shell-Moulding Resins. All the Cats in this family produce excellent shell mouldings, without 'peel-back'.

CATABOX This Cat will give you a choice of resins for the Hot Box process. There are Furane type or single stage phenolics. Catabox specialises in speed and quality.

CATAWASH Here's a whole family of Core and Mould Washes, bases and paints. Like all of the Catalin Cats they'll keep your castings really clean.

CATACOTE Better casting is this Cat's business—a cool Cat for the cold pre-coating of sand—for better shells at far less cost than conventional resins.

Catalin's specialised knowledge and years of research into foundry resins and resin conversion can help you in your foundry. Catalin will even breed new Cats to overcome your special problem. Ask a Catalin man to call and give you a Cat Show in your foundry.

Catalin Limited

CATALIN LIMITED, Waltham Abbey, Essex
Telephone: Waltham Cross 23344

Schieldrop

SELF-PROPORTIONING

OIL BURNERS

FOR

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AIR-OIL RATIO

By means of a simple lever operation these burners ensure an accurate control of air and oil ratio giving peak efficiency, outstanding accuracy and high product quality. Schieldrop pioneered the self-proportioning burner in Great Britain and their unrivalled experience in furnace firing is recognised by the leaders in British Industry.

Write for full details of Schieldrop Burners.

Schieldrop & COMPANY LIMITED

(Ass. with Hamworthy Eng. Ltd.)

STOTFOLD • Nr. HITCHIN • HERTS

TELEPHONE 414 (4 LINES)

Sixteenth century carving in the church of St. Peter and St. Paul, Drax, of pig playing bagpipes. Photograph by Ruth Meyler & F. C. Sillar

50 MILLION PIGS GO TO MARKET!

In the early days of the industrial revolution manufacturers frequently looked for familiar and easily recognisable descriptions of their products. To the countryman transplanted into industrial surroundings nothing was more familiar than a pig; a fact which is emphasised by carvings in scores of old churches depicting pigs suckling their litter, rooting for acorns and playing the bagpipes. (Apparently this last pastime was forsworn by pigs many years ago because of unpleasant associations between bagpipes and pigs bladders.) Consequently, when iron from Blast Furnaces was directed into long troughs and from there into short and narrow troughs placed at right angles, a resemblance to sows suckling their appendaged litter led to the description of 'pig iron'.

This series of advertisements illustrates some of the 'ecclesiastical' pigs and emphasises the 50,000,000 'special' pigs which Warner and Company have supplied to Iron Foundries producing High Duty Castings.

WARNER WARNER WARNER

"Pioneers of Refined Pigiron"

KA

WARNER & CO. LTD., MIDDLESBROUGH

S.C.B. 20

* **New design–rugged construction–fully automatic**
* **Push button control–fast, easy and efficient operation**
* **Oil-hydraulic operation with self-contained power pump**
* **Variable Blow position–time controlled Blow**
* **Adjustable Rocking during Cure–separate timers**
* **Unique Flip-Plate assembly "hands" core to operator–no contact with hot plates or boxes**

Accommodates core boxes up to:- 25" HEIGHT
20" WIDTH
14" DEPTH

Interchangeable heater plates up to:- 24" HEIGHT
20" WIDTH

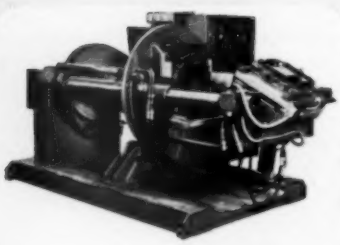
Electric heating—thermostat controlled

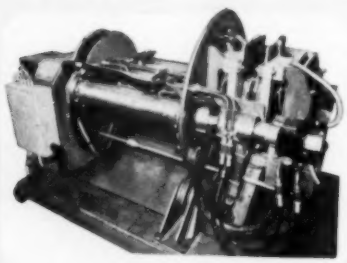
Designed for high speed production of medium/large shell cores—equivalent of up to 200 lbs solid weight

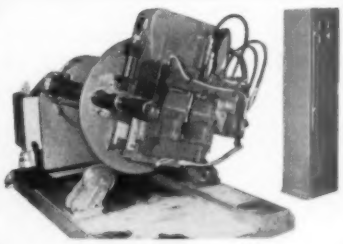
Ask for new leaflet, full details and quotation

Can we solve your Shell problem?

We make Sheil moulding machines for Shells, sizes:-
20" x 15" — 24" x 18" — 30" x 20" — 41" x 26"







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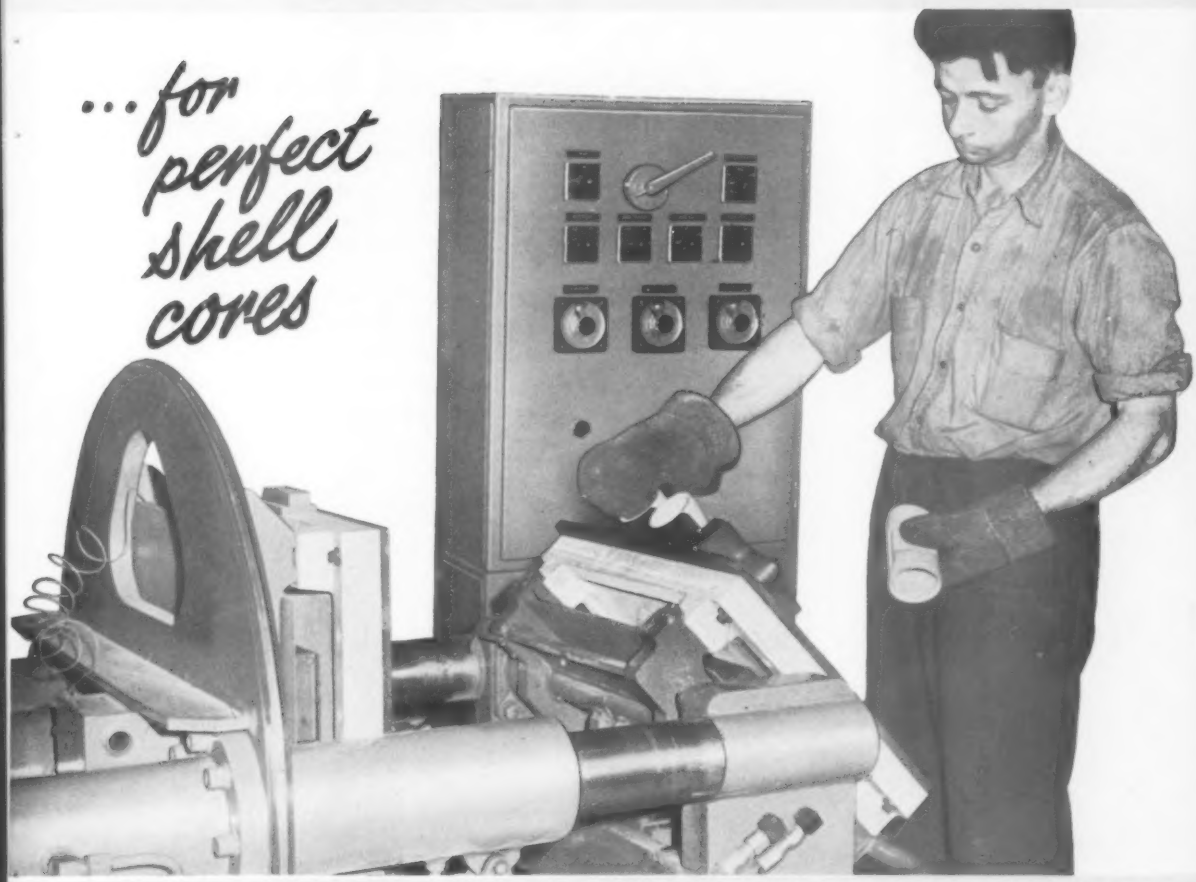
LIMITED

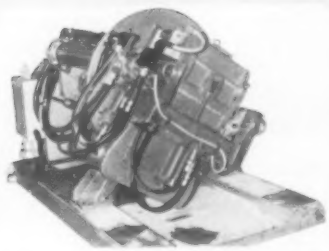
Leighton Buzzard, Bedfordshire, England

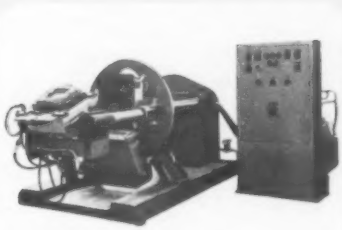
Telephone: Leighton Buzzard 2441 (5 lines) Telegrams: 'Equipment,' Leighton Buzzard, England

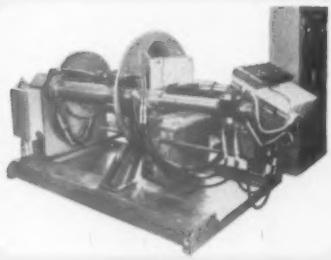
automatic shell core blower...

...for perfect shell cores









OVERSEAS COMPANIES:

AUSTRALIA: Foundry Equipment (Australia) Pty. Ltd., Elizabeth, S. Australia.
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Core and Mould Dressing

Prepared especially for
the CO_2 Process from selected graphites
and other materials

● Easy to mix and apply ● Good flash drying ● Prevents metal penetration and burn ● Reduces fettling to a minimum ● Suitable for ferrous and non-ferrous metals ● Economical in use

Photo by kind permission of Le Grand Western Foundries Ltd.

Foliac Core and Mould Dressing is an inflammable dressing which may be applied by brushing, dipping or spraying. It is not injurious to health. Easy to work, it can be used on all types of sands; it strips easily, leaving an excellent surface. Foliac Dressing prevents metal penetration when casting high-tin phosphor bronze.

A test with a free 7 lb sample will convince you of the superiority of this product. Write to:

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GPII2/T2

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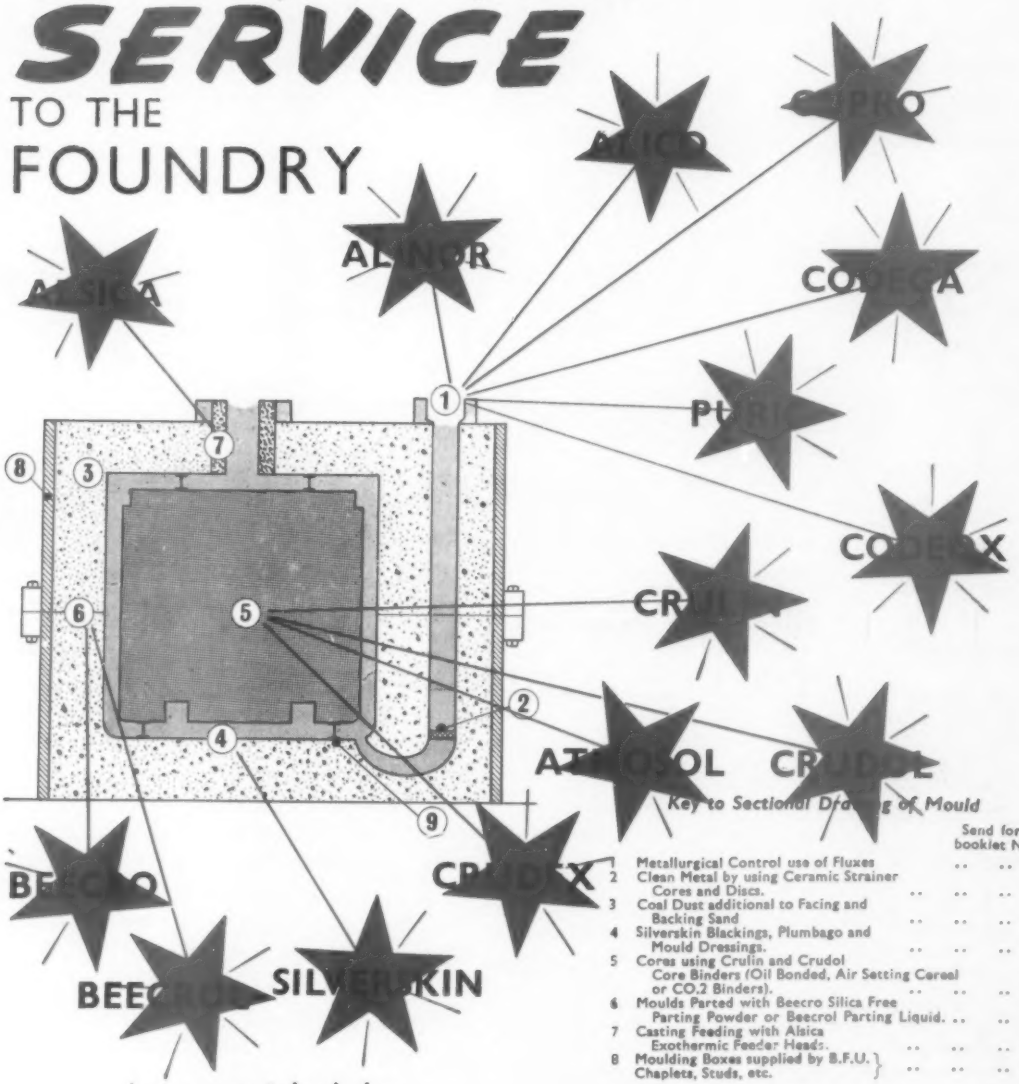

Key to Sectional Drawing of Mould

		Send for booklet No.
1	Metallurgical Control use of Fluxes	3
2	Clean Metal by using Ceramic Strainer Cores and Discs.	4
3	Coal Dust additional to Facing and Backing Sand	1
4	Silverskin Blackings, Plumbago and Mould Dressings.	1
5	Cores using Crulin and Crudol Core Binders (Oil Bonded, Air Setting Cereal or CO_2 Binders).	2
6	Moulds Parted with Beecro Silica Free Parting Powder or Beecrol Parting Liquid.	1
7	Casting Feeding with Alsica Exothermic Feeder Heads.	4
8	Moulding Boxes supplied by B.F.U. Chaplets, Studs, etc.	5

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BRITISH FOUNDRY UNITS LTD.,

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FOR THE ONLY COMPLETE SERVICE TO THE FOUNDRY

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Telephone : 4157/8 Telegrams : "RETORT"

CO_2 SILICATE PROCESS
CO_2 SILICATE PROCESS

QUICK CHANGE TO I.C.I. LIQUID CO_2

The East Sussex Engineering Co. Ltd. is an old-established foundry with modern ideas. They use up-to-date techniques like the CO_2/Silicate process for the speedy production of high quality moulds and cores. Recently, they decided to change to bulk supply of I.C.I. liquid CO_2, and install I.C.I.'s 5-ton storage tank.

To avoid interrupting normal foundry production, the installation took place over a weekend. The tank was delivered on Friday, installed on Saturday, and in operation on Monday. I.C.I. Technical Service staff were there to supervise start-up, and show the foundry operators how to use the tank. Foundry work went on as usual.

For a sizeable foundry like East Sussex Engineering, buying liquid CO_2 in bulk is clearly a sound proposition, but even if you use as little as 30 tons a year, the I.C.I. liquid CO_2 tank is still a good investment. It means you buy CO_2 the cheapest way—as liquid in bulk.

If you would like to know more about the advantages of bulk supply of I.C.I. liquid CO_2, get in touch with:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1.

I.C.I. PRODUCTS AND THE CO_2 SILICATE PROCESS

The East Sussex Engineering Co. Ltd. uses the CO_2/Silicate process for making moulds and cores. The CO_2/Silicate process eliminates stoving, cuts fuel costs, cuts handling charges, saves time, and increases output. I.C.I. supplies for the CO_2/Silicate process:

CARBON DIOXIDE

'Drikold' solid CO_2 used in the 'Drikold' liquefier—a convenient source of CO_2 for smaller foundries.

Liquid CO_2 in bulk and I.C.I.'s 5-ton storage tank—recommended for the larger foundry.

SODIUM SILICATE

grades C.112 and C.125—supplied in 10- or 45-gallon drums, and in road or rail tank vehicles.

ISOPROPANOL

for the preparation of ignitable mould or core dressings. Refined isopropanol or 'Imsol' A (isopropanol/water azeotrope)—supplied in 45-gallon drums or in road or rail tank vehicles.

TECHNICAL SERVICE

The skill and experience of I.C.I.'s Technical Service staff are available for the assistance of customers both in the selection of products and the operation of the CO_2/Silicate process. For a visit by a technical service representative, or for further information, get in touch with:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1. DK.350

CO_2 SILICATE PROCESS

Austins have been 'Metal People' for nearly 90 Years and still lead the field both at home and abroad. They have built up a reputation of being *the* people for non-ferrous metals, so why not approach them today if you require; Aluminium alloys, Copper alloys, Gunmetal, Aluminium Bronze, Manganese Bronze, Phosphor Bronze, Lead Bronze Brass, Lead, Tin, Zinc, Solders, Typemetals.

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But man ***can*** *control the other three,*
and none better than those responsible
for producing the high grade refined
iron welcomed by resourceful foundrymen
and discerning metallurgists everywhere.

BRADLEY & FOSTER LIMITED

FOR QUALITY CONTROLLED REFINED PIG IRON

DARLASTON · STAFFORDSHIRE

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we can control
electric arc furnace fumes

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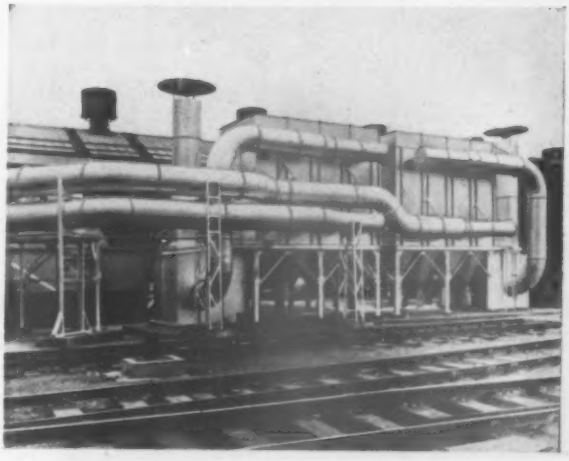

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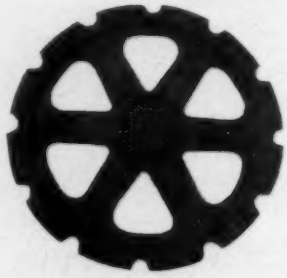

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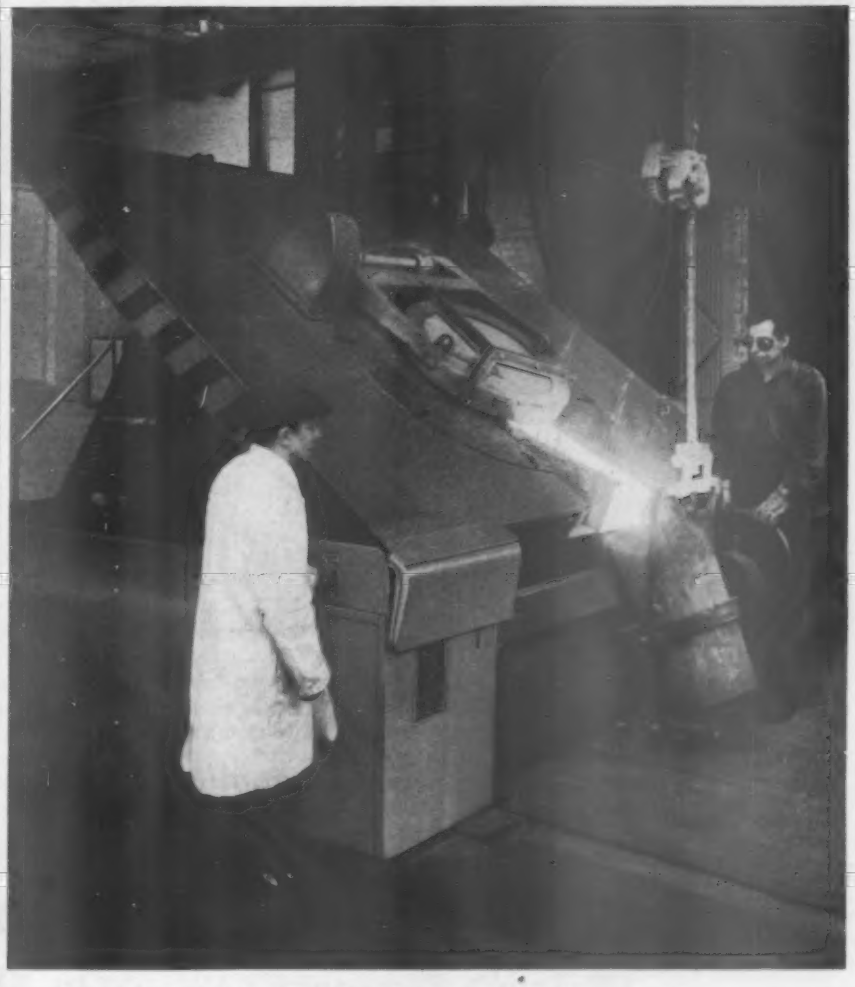

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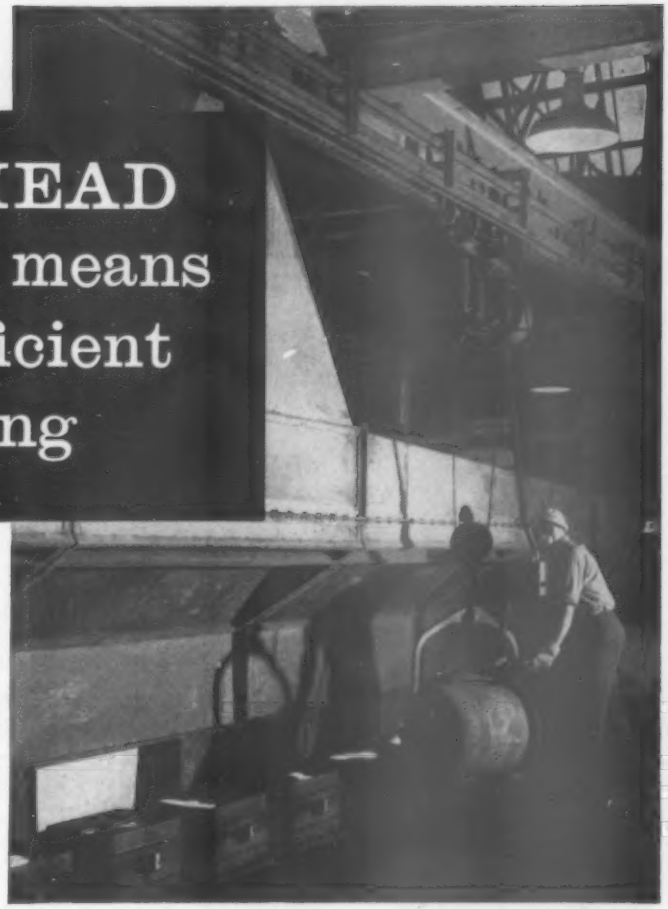

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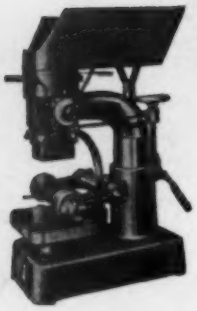

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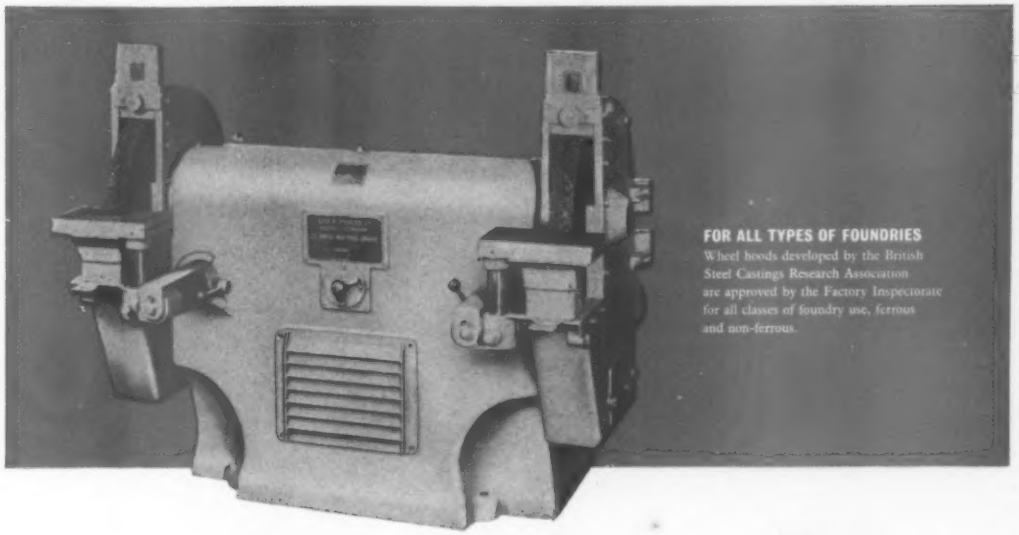

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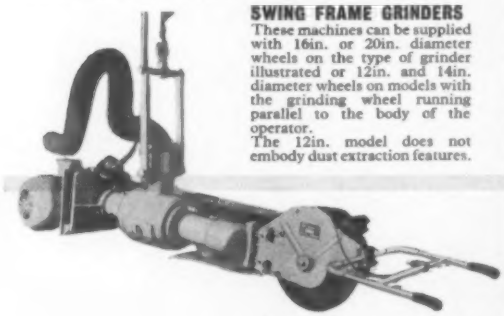

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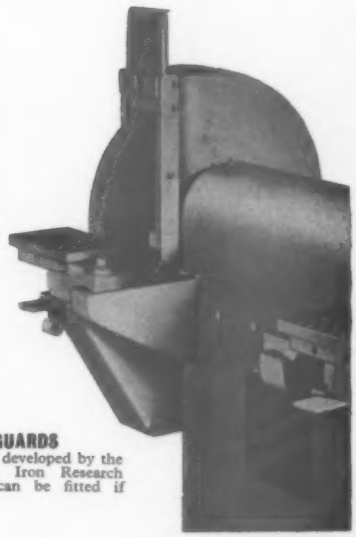

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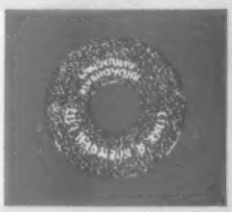

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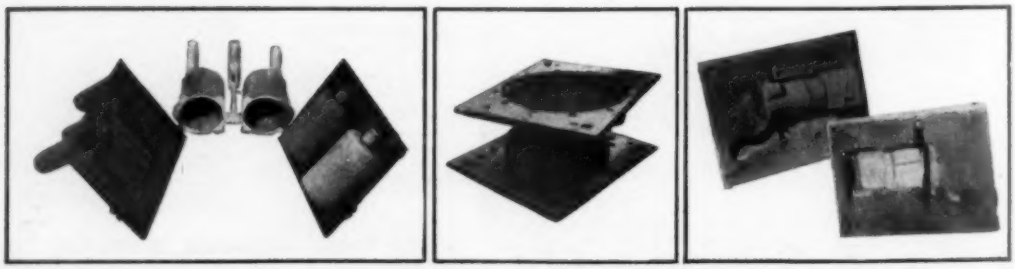

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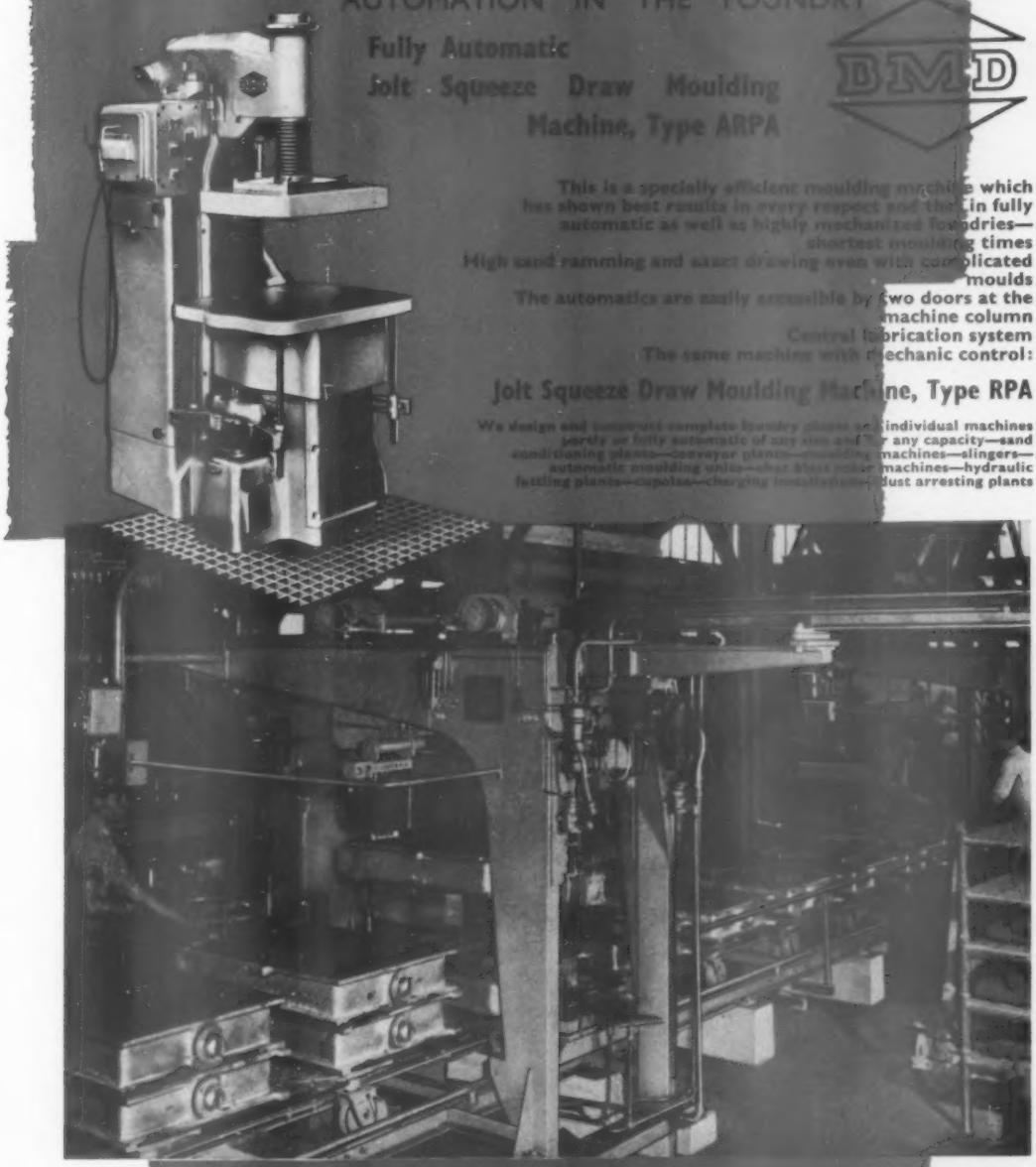

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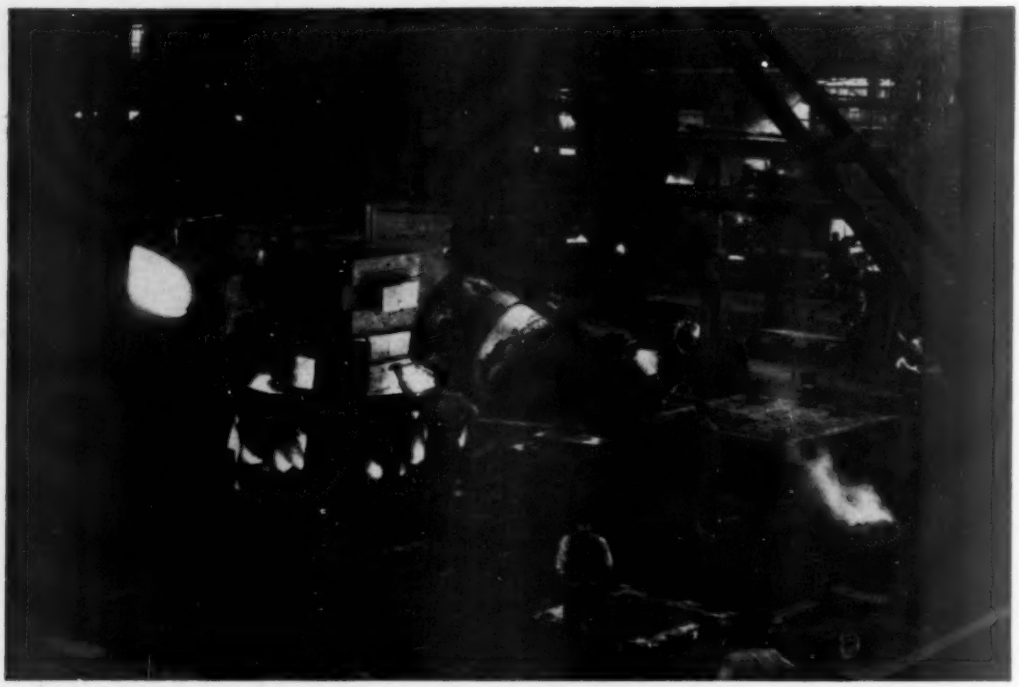

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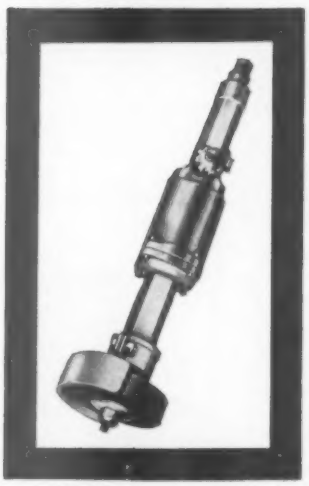

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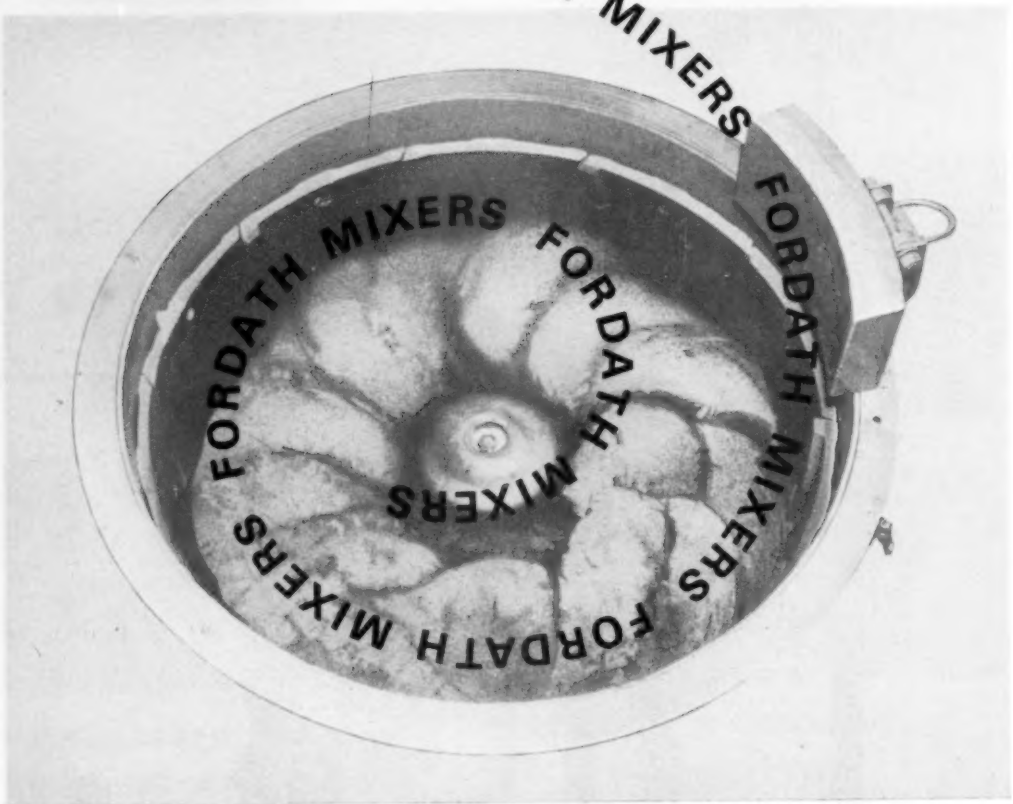

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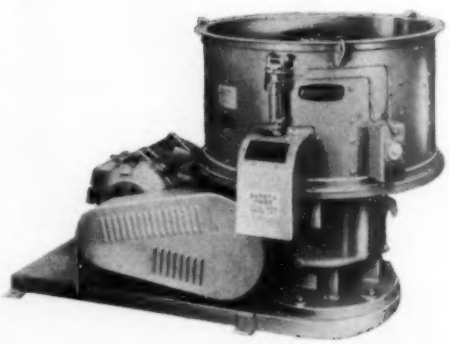

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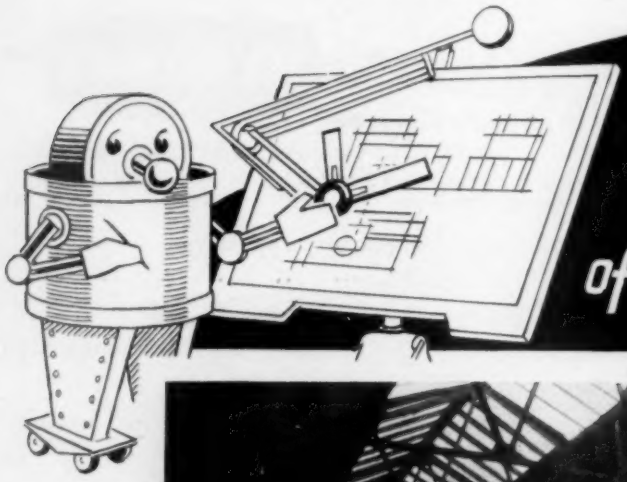
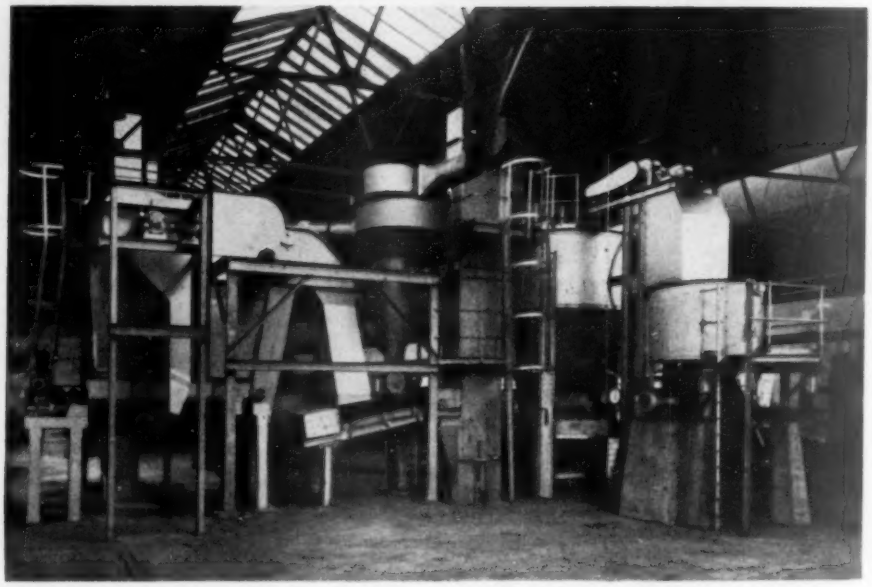


PLANNING FOUNDRIES *of the* FUTURE



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Photograph shows compact sand reconditioning and preparation plant comprising, left to right, elevator, rotary screen and tailing chute, screw conveyor,

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FOUNDRY
TRADE JOURNAL
Vol. 111 October 5, 1961 No. 2339

1960 Factory Report*

Mr. John Hare, Minister of Labour, was present when Mr. T. W. McCullough, HM Chief Inspector of Factories, held his Press conference on the 1960 Factory Report, as he deemed it desirous to express his " serious concern " at the rise of nine per cent. over the 1959 casualties. At 190,266, the figure was the highest for 10 years. What expression he would have used if he had been talking expressly to the foundry industry, it is difficult to imagine, for the Report records for our industry 9,993 accidents, of which 15 were fatal. The total shows an increase of 1,642—there being 7,214 in ironfounding, 1,349 in steelfounding, 432 for die-casting and 998 for non-ferrous work. The corresponding figures for 1959 were 5,962, 1,164, 350 and 875. Obviously, the increase in the foundry industry has been much higher than national level. The Minister, in searching for means to lower the incidence of industrial accidents, suggested *inter alia* that it was on an industry basis that this problem should be tackled. Here, at least, the largest of the branches of the employers' associations serving the foundry industry does already operate a keen accident-prevention committee, but the direct work must be done by enthusiastic co-operation in the actual foundries.

In common with other industries, the handling of goods in the foundry accounts for a third of the reported injuries, except for die-castings where it is just over a quarter. The remedy suggested by Mr. McCullough is the better planning of production and movement. He stressed the need for the increased use of safety clothing and noted how amongst motor cyclists the wearing of helmets was now *de rigeur*. Emulation by industry would be helped if executives would set the example. It should be remembered that there were reported over 1,000 accidents due to falling objects. The Chief Inspector drew attention to the fact that accidents to boys in industry had increased by 17 per cent. and this appalling situation must be given priority in the deliberations of all accident-prevention officials—*i.e.*, all executives and the committees studying the general problem.

Our overseas readers will probably have received the impression from the foregoing that insufficient care is taken in application of accident-prevention measures. To dispel any complacency they may feel, however, the following figures are quoted from the latest available International Labour Office statistics for fatal accidents per 1,000 workpeople—Great Britain 0·05 (1960); Japan 0·12 (1959); USA 0·10 (1959); France 0·14 (1958); and Germany and Italy both 0·20 (1957). Thus, it is obvious that the problem of accident prevention and reduction is worldwide and readers beyond the confines of this country will find the Report helpful in the solution of their own problems.

* Annual Report of the Chief Inspector of Factories, 1960. Published by H M Stationery Office, York House, Kingsway, London, W.C.2. price 7s. plus postage.

IBF Golf Meeting

The annual competitions of the Golfing Society of the Institute of British Foundrymen, held this year on September 23 and 24 at the usual venue, Woodhall Spa, Lincolnshire, attracted a good entry of 54 competitors, 12 of whom were ladies. The various results are recorded in what follows:—

Saturday morning: Stroke competition for the IBF Handicap and Scratch Cup (42 competitors).

1. V. Brackenbury ..	86—17=69	Winner Handicap Cup.
2. G. W. Littlewood ..	86—15=71	Winner Veteran's Cup.
3. R. C. Shepherd ..	84—12=72	
4. A. T. Johnston ..	86—12=74	
5. C. S. Bosworth ..	88—13=75	
6. H. L. Thorne ..	83— 8=75	
7. H. Oliver	92—17=75	
8. T. H. Taft	96—21=75	
9. E. Clipson	92—17=75	
10. G. W. Nicholls ..	90—14=76	
11. R. T. Turner ..	82— 6=76	Winner Scratch Cup.
12. E. J. Turner ..	83— 7=76	
13. C. D. Anderson ..	95—19=76	
14. L. A. Bailey	89—12=77	
15. L. Mortlock ..	87—10=77	

The IBF Coronation Shield was retained by the holders, the Lincolnshire branch team of Mr. C. S. Bosworth (75); Mr. E. Clipson (75) and Mr. D. Killingworth (86), their best two cards totalling 150 beating the first team of the West Riding of Yorkshire branch and the second team of the Lincolnshire branch by one stroke.

Saturday afternoon: Two-ball foursome against bogey (36 competitors).

1. L. Mortlock and T. R. Reynolds	3 up
2. M. H. Hillman and E. Clipson	2 up.
3. A. T. Johnston and L. Wright	2 up.
4. G. W. Nicholls and E. A. Phillips	All square
5. J. G. Phillips and D. Killingworth	2 down

Sunday morning: Stableford fourballs (34 competitors).

1. P. D. Pincott and R. Plant	45 points
2. L. A. Bailey and J. C. Simpson	43 points
3. P. B. Higgins and G. W. Nicholls	42 points
4. H. Beck and L. Mortlock	42 points
5. E. Clipson and L. Wright	41 points

Ladies' Competition (Saturday).

The ladies' competition for the Coronation Rose Bowl attracted 12 competitors, the score cards being as follow:—

1. Mrs. J. G. Thorne	37 points
2. Mrs. R. C. Shepherd	29 points
3. Mrs. P. D. Pincott	29 points
4. Mrs. R. T. Turner	28 points
5. Mrs. C. T. Sandford	26 points

The Society was honoured to have as its guests the IBF president, Mr. D. A. Richards, and Mrs. Richards, and the IBF secretary, Mr. G. Lambert, and Mrs. Lambert. The prizes were very graciously presented by Mrs. Richards. In the absence of the Golfing Society president, Mr. G. Pennington, Mr. Charles Wilson took the chair at the annual general meeting at which Mr. Pennington was re-elected president. Mr. Wilson called for nominations and volunteers for the office of secretary, as Mr. J. Graham Phillips wished to relinquish this position which he had held for three years. There were, however, no nominations and Mr. Phillips agreed to continue as secretary until such time as his successor was appointed.

The meeting was followed by an informal dinner/dance, which was greatly enjoyed by the company. (The date of the 1962 IBF Golfing Society's meeting will be September 22 and 23 at the same venue.)

Forthcoming Events

OCTOBER 9

Institute of Metals

Scottish local section:—"Physical Methods of Analysis for Major Alloying Constituents," by K. M. Bills, 6.30 p.m., in the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow, C.2.

Institute of Vitreous Enamellers

Midland section:—" Enamelling Glass and Pottery," by W. R. Povey, 7.30 p.m., at the Kings Head Hotel, Bearwood.

OCTOBER 10

Institute of British Foundrymen

Slough section:—Afternoon works visit to the Pulsometer Engineering Company, Limited. Evening meeting also at Pulsometer Engineering Company, when Mr. A. A. Timmins will give a paper on "Some Applications of Work-study in the Foundry."

Institution of Mechanical Engineers

Automobile division:—Chairman's address on the " Importance of the Design Stage," 6.30 p.m., at 1, Birdcage Walk, Westminster, London, S.W.1.

Institution of Plant Engineers

Edinburgh branch:—" Organization of Preventive Maintenance," by D. C. Muirhead, 7.30 p.m., at 25, Charlotte Square.

OCTOBER 11

Institution of Production Engineers

Coventry graduate section:—" Future Trends in Machine-tool Design," by Prof. J. Loxham, 7.30 p.m., in the Courtauld Lecture Theatre, Lockhurst Lane.

Western graduate section:—" Management/Trade Union Relationship in Industry," by S. J. West and P. E. Stanford, 7.30 p.m., in the Main Lecture Theatre, Faculty of Engineering, Queen's Building, University of Bristol.

Institute of British Foundrymen

Southampton section:—" Use of Oxygen in Cupolas and other Developments," by C. H. King and F. B. Lawrence, 7.30 p.m., at the Technical College, St. Mary's Street.

OCTOBER 12

Institute of British Foundrymen

Beds. & Herts. section:—Presidential address followed by a film show at K. & L. Steelfounders & Engineers, Limited, Letchworth, Herts.

Birmingham branch:—Special meeting for associates; followed by " Factors influencing Soundness," by J. L. Francis, 7.30 p.m., at the County Technical College, Kenrick Street, Wednesbury.

Institution of Production Engineers

Luton graduate section:—Works visit to Austin Motor Company, Limited, 10.15 a.m., rendezvous Exhibition Hall.

Preston section:—" Human Relations in Industry," by R. H. J. Rhodes, 7.30 p.m., at the Accrington College of Further Education, Sandy Lane, Accrington.

East Midlands Metallurgical Society

" Aspects of Metallurgical Training," by M. I. McIntyre, 7.30 p.m., at the Derby and District College of Art.

Institution of Plant Engineers

Glasgow branch:—" Accident Prevention from the Plant Engineer's Standpoint," a tripartite meeting presented by H.M. Factory Inspector, an industrial officer and a member of the branch committee, 7.15 p.m., at the Scottish Building Centre, 425, Sauchiehall Street.

OCTOBER 13

Institute of British Foundrymen

Tees-side branch:—" Dust, the Devil, and the Doctor," by Dr. G. MacBain, 7.30 p.m., at the Darlington Forge, Limited.

West of England Metallurgical Society

" Potential Influence of Theory in Practice," by D. McLean, 7 p.m., at the College of Science and Technology, Ashley Down, Bristol 7.

OCTOBER 14

Institute of British Foundrymen

Scottish branch:—Presidential address by J. S. McMillan, followed by " Some Non-ferrous Castings for Mining Machinery," by R. Ferguson, 2.30 p.m., at the Royal College of Science and Technology, Glasgow.

How to Choose a Gunmetal*

By J. E. Stolarcyzk, A.C.T.(Batt.), A.I.M.

The results of recent research on the effects of structure and composition on the properties of gunmetals are used to suggest the best alloys and pouring conditions for common casting applications. In this way the usefulness of the standard gunmetals is assessed and some new compositions are suggested.

Gunmetals are among the most commonly used alloys in the non-ferrous foundry but their compositions have been standardized mainly on the basis of haphazard experience of a limited number of alloys rather than systematic investigation. The British Non-Ferrous Metals Research Association has recently undertaken an extensive research[1] to determine whether the existing commercial alloys have the best combination of properties for their normal applications.

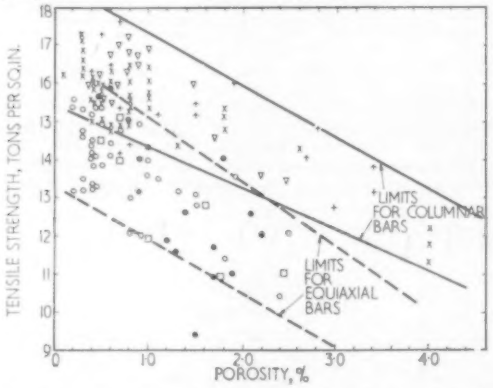


FIG. 1.—*Influence of porosity on the tensile strength of test-bars of 85/5/5/5 gunmetal with equiaxial or columnar grain-structures.*

Key :—▽ D.T.D., + B.S.I., × I.B.F. Bars with columnar grain-structure; ○ D.T.D., ● B.S.I., □ I.B.F., bars with equiaxial grain-structure.

In the present paper the effects of grain structure and microporosity on the properties of gunmetal castings are first discussed briefly and some suggestions made on how structure and soundness can be controlled. The detailed information now available on the influence of composition on the properties of gunmetals is then used to select the best compositions for some common applications.†

* Based on a paper presented by the Author at the Cheltenham conference of the Institute of British Foundrymen, entitled "Structure and Properties of Sand-cast Gunmetals." The Author, who was previously attached to the British Non-Ferrous Metals Research Association is now with J. Stone & Company (Charlton) Limited.

† Until recently the BNFMRA's work was largely concerned with nickel-free gunmetals and although the influence of nickel additions is now under investigation by the Association, with the support of the International Nickel Company (Mond) Limited, they are not considered here. Some information on a nickel gunmetal has been presented in a recent paper by Hudson.[6]

Structure and Microporosity

Grain Structure

The effects of composition on properties must be considered separately for columnar and equiaxial grain-structures because gunmetal castings having these structures differ considerably both in tensile properties and in pressure-tightness. In practice, both structures are encountered in gunmetal castings. There is no doubt that the highest tensile and pressure-tightness properties in these alloys are associated with the columnar structure, and casting conditions which produce such a structure should therefore be employed whenever possible.[3, 4, 5] The influence of microstructure on the tensile strength of test bars is illustrated in Fig. 1. Its influence on the pressure-tightness of a disc casting is shown in Fig. 2.

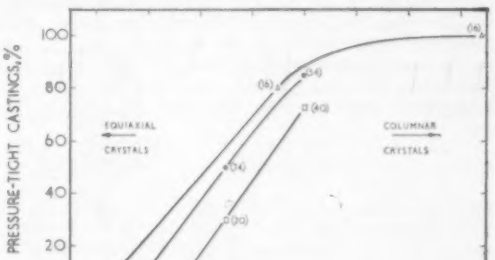


FIG. 2.—*Influence of pouring temperature on the pressure-tightness of gunmetal disc castings. Columnar structures are produced at higher pouring temperatures, equiaxial at lower, and mixed structures at intermediate temperatures.*

Key :— △—△ 87½/7½/2/3 alloy with ¼-in. gates; ●—● 85/5/5/5 alloy and ¼-in. gates, and □—□ 88/10/2 alloy, with ¼-in. gates.

The highest tensile properties in most gunmetal test-bars are obtained with a pouring temperature of about 1,160 deg. C., because with this temperature a columnar grain structure is generally formed in such castings. However, it is not possible to specify a single, optimum pouring temperature for all types of casting poured under varying conditions, particularly where a series is cast from a single ladle. All that can be said is that the formation of a columnar grain-structure is favoured by high casting temperatures and

How to Choose a Gunmetal

by the use of well-designed running systems which ensure fast but not agitated flow of the metal. The optimum pouring temperature for each type of casting, therefore, will be largely a matter of experience or will have to be arrived at by trial and error. In the majority of light-section commercial castings, the pouring temperature would generally have to exceed 1,160 or 1,180 deg. C. to obtain the required grain-structure, coupled with slight gas pick-up that also has a beneficial influence on pressure-tightness. On the other hand, excessive temperatures should be avoided, particularly with moderate or heavy sections, because the beneficial effects of a columnar structure would then be counteracted by the gross gas porosity which tends to form under these conditions, whether from pick-up in melting or from mould reaction after pouring.

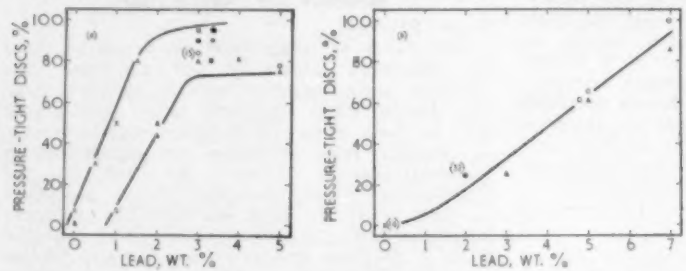
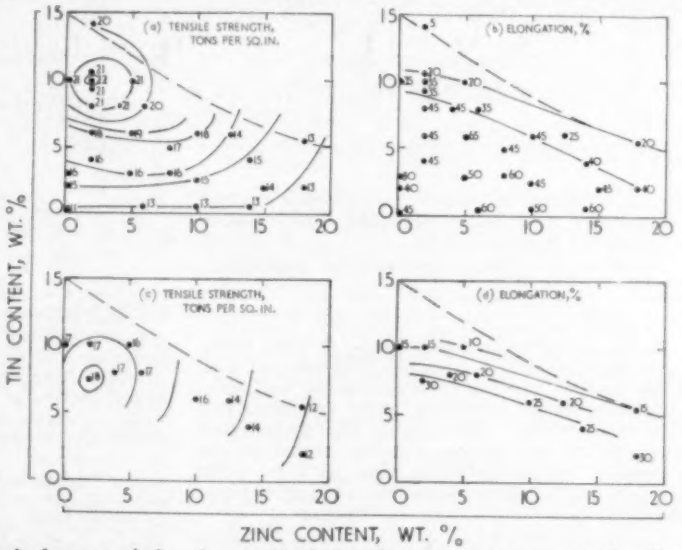


FIG. 3.—*Influence of lead content on the pressure-tightness of gunmetal disc castings, poured under two sets of conditions (a) columnar structures, ¼- in. gates, and (b) equiaxial structures, ⅛-in. gates.*

(a) Key: Sn 7½ 3 7 10 7½ 6 9½ 7½ 5; Zn 2 8 5 2 ½ 2 2 3½ 5.
(b) Key: Sn 7½ 5 10 3 7; Zn 2 5 2 8 5.

Fig. 4.—*Influence of tin and zinc contents on the tensile properties of sand-cast DTD test-bars in lead-free gunmetals, (a) and (b) are columnar structures, and (c) and (d) equiaxial structures. The casting temperature was* 1,150 *to* 1,160 *deg. C., and the dashed line represents solid solubility at* 500 *deg. C.*


(a) TENSILE STRENGTH, TONS PER SQ. IN.
(b) ELONGATION, %
(c) TENSILE STRENGTH, TONS PER SQ. IN.
(d) ELONGATION, %
TIN CONTENT, WT. %
ZINC CONTENT, WT. %

Degassing

Degassing of gunmetals, when required, can be carried out cheaply and effectively, either by bubbling nitrogen through the melt for a period of about five minutes (using about 5 cu. ft. per ton), or by the use of proprietary degassing tablets. Degassing may be used as a corrective measure with medium- or heavy-section castings if it is observed that excessive amounts of gas are being picked up during melting. For light section castings (up to ¼- or ½-in. thick) limiting the gas pick-up by control of furnace conditions is generally sufficient. For both light and heavy section castings, however, it has been found that the reduction of melting losses effected by using a charcoal cover to obviate oxidizing conditions during melting can more than repay the cost of nitrogen degassing.

Deoxidation and Mould Reaction

Control is also required on the content of phosphorus. This is usually added to reduce steam evolution by combining with most of the oxygen; when present in excessive amounts, however, it can introduce severe porosity by promoting gas pick-up from the reaction with steam in the mould—*i.e.*, mould reaction. Research and practical experience show that usually, for best results, the residual-phosphorus content probably lies between 0.01 and 0.03 per cent. However, a higher phosphorus content (0.05 to 0.08 per cent.) may be used for improving pressure-tightness in especially-difficult light-section castings, as the consequent slight gas pick-up resulting from mould reaction is achieved more consistently in this way than by relying on gas pick-up during melting.

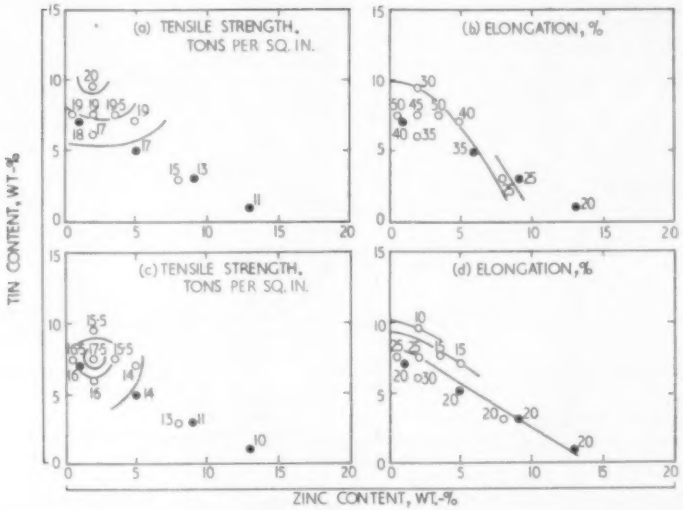

(a) TENSILE STRENGTH, TONS PER SQ. IN.
(b) ELONGATION, %
(c) TENSILE STRENGTH, TONS PER SQ. IN.
(d) ELONGATION, %
TIN CONTENT, WT.-%
ZINC CONTENT, WT.-%

FIG. 5.—*Influence of tin and zinc contents on the tensile properties of sand-cast DTD bars in leaded gunmetals, (a) and (b) are columnar structures, and (c) and (d) equiaxial structures; casting temperature* 1,150 *to* 1,160 *deg. C.*

Key :— □ — 3 per cent. lead; ● — 5 per cent. lead.

All these points are illustrated in Table 1, which demonstrates what happens to the properties of gunmetals when departures from the ideal conditions are made, either through inadequate control or because production conditions in some jobbing foundries may make it impossible to avoid such departures.

Choice of Alloy

Let us choose three common casting applications and try to suggest the most suitable alloy for each.

Thin-section Castings for Steam Service

Consider first a thin-walled valve casting which is required to operate at steam temperatures of up to say 550 deg. F. The valve must (1) be pressure-tight, (2) be reasonably stiff, and (3) have good resistance to creep at elevated temperatures. While some lead-free gunmetals are better than others, high pressure-tightness in thin, intricate castings is most easily obtained if lead is present. Fig. 3 shows pressure-tightness as a function of lead content for two test castings, one of which

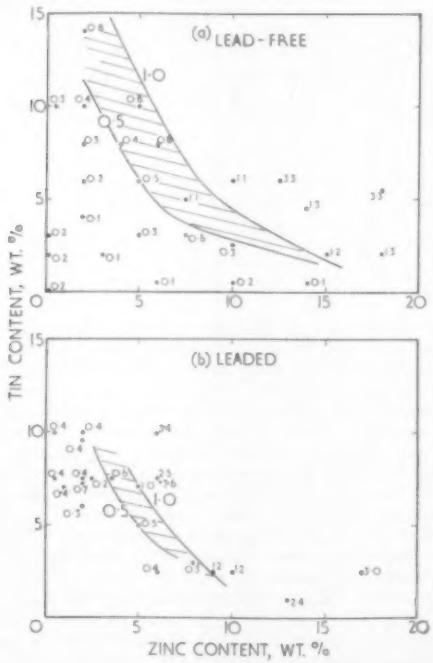


FIG. 6.—*Influence of composition on porosity of lead-free and leaded gunmetals with sand-cast DTD bars poured at* 1,150 *to* 1,170 *deg. C. Numerals next to each point indicate percentage of porosity.*

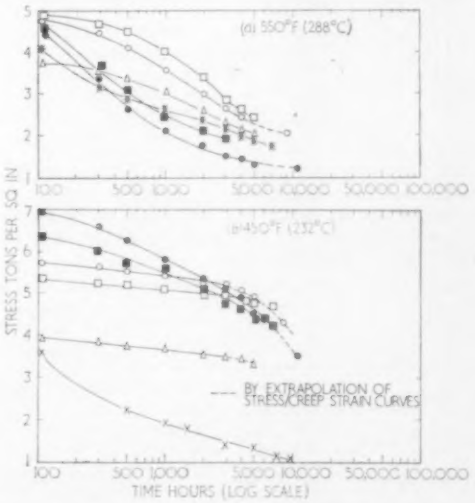


FIG. 7.—0.1 *per cent. plastic creep strain curves for gunmeals and a wrought brass.*

Key: (Cu/Sn/Zn/Pb □—□ 85/5/5/5[15]; ○—○ 86/7/5/2[14]; □—□ 87½/7½/2/3; ●—● 88/10/2/0[13]; ★—★ 84/6½/2/3; △—△ 86/3/8/3; ×—× 58/0/40/2 (wrought brass).

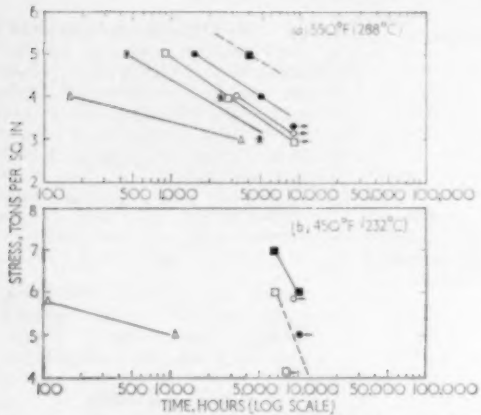


FIG. 8.—*Stress-to-rupture curves for gunmetals.*
Key :— □ — 85/5/5/5; ■ — 87½/7½/2/3; ○—86/7/5/2; ● —88/10/2; ★ — 88½/6½/2/3; △ — 86/3/8/3.

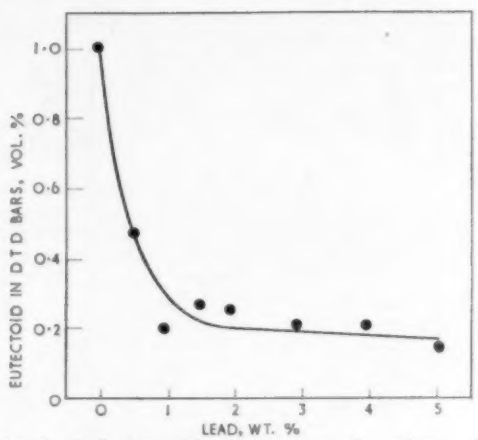


FIG. 9.—*Influence of lead content on the volume of eutectoid in leaded gunmetals.*

was difficult to make pressure-tight because it was made under conditions producing an equiaxial grain-structure, while the second was easier, having a columnar structure. The pressure-tightness in each case increases with lead content, but in practice significant lead segregation in castings is observed at about six to seven per cent. and therefore the optimum lead content for pressure-tightness appears to be about five per cent.

Turning to Figs. 4 and 5 we see that the strength of the alloys rises with the tin content. But so does the price. The best compromise appears to be about five per cent. tin. However, if a lower stiffness can be tolerated then the cheaper three per cent. tin alloy could be acceptable. Strength increases with zinc content only up to two per cent. In Fig. 6 the effect of zinc content on porosity is shown. At each tin content there is a maximum zinc content which can be tolerated, beyond which a rapid increase in porosity is observed. The five per cent. tin alloy can tolerate about five per cent. zinc, while with the three per cent. tin alloy the zinc content could be increased to about seven to eight per cent. There are, therefore, now two alloys, the 85/5/5/5 (BS 1400-LG2) and the 84/3/8/5 (BS 1400-LG1) gunmetals. The creep resistance of the former for long times or at high temperatures is outstanding, as shown in Fig. 7. The other gunmetal, although not so strong at low temperatures, has comparatively-good creep resistance at high temperatures. These two existing standard gunmetals, therefore, are not to be bettered for this type of application.

TABLE 1.—*Influence of Casting Temperature, Gas Pick-up and Mould-reaction on the Porosity and Tensile Properties of Five Sand-cast Gunmetals.*

Condition.	Properties.	DTD bars.					3-in. thick plates.				
		10/2/0	7½/2/3	7/5/2	5/5/5	3/8/5	10/2/0	7½/2/3	7/5/2	5/5/5	3/8/5
Normal	Porosity, per cent.	0.3	0.4	1.0	0.5	0.3	4½	3	5½	5	5
	Tensile strength, tons per sq. in.	21½	20	19	17	15	12	13½	10½	9½	5½
	Elongation, per cent.	35	50	45	40	35	15	30	20	15	10
Too-high casting temperature (1,240 deg. C.)	Porosity, per cent.	0.8	1.4	3.4	1.4	1.7					
	Tensile strength, tons per sq. in.	20½	18	16½	14½	11					
	Elongation, per cent.	30	35	20	20	15					
High phosphorus content (0.06 per cent.)	Porosity, per cent.	0.6	1.4	3.3	1.7	1.3	4½	4	6½	5	5½
	Tensile strength, tons per sq. in.	18½	14½	12	11	12					
	Elongation, per cent.	20	15	10	15	20					
Gassy	Porosity, per cent.	2.5	1.7	4.0	1.8	2.4	6	5½	8	5½	7
	Tensile strength, tons per sq. in.	14½	15½	11½	10½	8½	10½	11½	8	8	6
	Elongation, per cent.	15	25	15	15	10	15	20	15	15	10

TABLE 2.—*Results of Four-week Sea-water Jet Impingement Tests of Gunmetals.*

Nominal composition (per cent.)	Attack at jet (mm.)	Attack elsewhere
Cu-10Sn-2Zn	Nil	Nil
	,,	,,
Cu-10Sn-2Zn-1Pb	Nil	Nil
	,,	,,
Cu-7½Sn-2Zn-3Pb	Nil	Very slight roughening
	,,	
Cu-7Sn-5Zn-2Pb	Trace	Slight roughening
	0.02	
Cu-5Sn-5Zn-5Pb	0.05	Slight roughening
	0.09	

TABLE 3.—*Comparison of the Effects of Tin and Lead Additions on the Properties of* 88/10/2 *Gunmetal.*

Composition, per cent.				Tensile properties of test bars.		Pressure-tightness of disc castings.	
Cu.	Sn.	Zn.	Pb.	Tensile strength, tons per sq. in.	Elongation, per cent.	¾ in. gates, per cent.	½ in. gates, per cent.
88	9½	2	0	20.8	33.0	70	7
87½	9½	2	1	20.9	39.0	100	50
87½	10½	2	0	20.7	20.0	85	—

TABLE 4.—*Comparison of Commercial and Experimental Gunmetals.*

Property.		Grain structure of form of test piece.	Alloy (Sn, Zn, Pb), per cent.				
			10/2/0	7/5/2	5/5/5	3/8/5	7½/2/3
Pressure-tightness (in order)			4	3	1	1	2
Creep	Stress to cause 0.1 per cent. of plastic strain in 10,000 hrs at 550 deg. F. (288 deg. C.)		1.2	2.0	2.0	1.8	1.6
	Creep ductility at fracture..		High	Moderate	Low	Low	Moderate
Tensile properties of castings	Tensile strength, tons per sq. in.	Test bars	16½-21½	14-19½	14-17	13-15	17-20
		A poorly fed section ..	15	11	10	7	13
		Thick sections (2 to 3 in.)	12½	11	10	5	14
	0.1 per cent. proof stress ..		10	7	6½	5	8
	Elongation, per cent. ..	Test bars	17-35	17-45	20-40	20-35	25-50
		A poorly fed section ..	13	15	10	8	25
		Thick sections (2 to 3 in.)	15	20	15	10	30

Thick Section

Consider a casting possessing thick sections where strength is a main requirement. This is an application for which normally the 88/10/2 (BS 1400-G1) or the 86/7/5/2 (BS 1400-LG3) gunmetals would once have been considered. Pressure-tightness is now a question of choosing a composition that is not prone to form porosity in heavy sections, rather than using a high-lead content; for the thick section, if sound, can be relied upon to produce pressure-tightness. The key to this selection, therefore, is the variation of strength and porosity with composition. In such a section the structure will be at least partly equiaxial. Figs. 4(*c*) and (*d*) indicate that with such a structure the highest strength, with adequate ductility, will be obtained at seven to eight per cent. tin and two per cent. zinc. We can also see from Fig. 6 that this composition is well within the low-porosity region while the two standard alloys, the 88/10/2 and the 86/7/5/2 gunmetals, are either on the edge or within the field of high porosity.

These differences in porosity between the three alloys are particularly important in thick sections as it has been shown that the compositions forming high porosities in thick sections tend to extend towards lower tin and zinc contents than shown for a comparatively thin section in Fig. 6.

It follows, therefore, that an alloy with seven to eight per cent. tin and two per cent. zinc possesses higher strength and soundness, under these conditions, than either of the other two gunmetals. Furthermore it has been shown that additions of lead not exceeding three per cent. improve pressure-tightness without significantly affecting mechanical properties. For this type of application, therefore, the new 87½/7½/2/3 composition known as the BNF gunmetal is more suitable than any existing standard alloy. Table 1 confirms the superiority of this alloy in heavy sections, as does recent work by Hudson.[2]

Sea-water Corrosion-resistant Thin Sections of High Strength

The third type to be considered is a casting with thin sections in which strength is important. If the casting could always be made in such a way that all sections possess a columnar structure the 88/10/2 gunmetal would be the strongest, as is shown by reference to Figs. 4(*a*) and 5(*a*). However, in practice at least parts of the casting will often possess equiaxial grains. Therefore even in this type of application as good tensile properties may be obtained with the 87½/7½/2/3 gunmetal, with much better pressure-tightness, as with the 88/10/2 alloy. In some castings of this type, resistance to sea-water corrosion is an important requirement. Tests summarized in Table 2 show that all gunmetals are good in this respect but suggest that the 88/10/2 and 87½/7½/2/3 gunmetals have probably a slight edge on the others even if an addition of one per cent. lead is made to the 88/10/2 alloy. This is a valuable finding because the one per cent. lead addition considerably improves ductility and pressure-tightness of the 88/10/2 gunmetal. Fig. 9 shows that the lead phase tends to dissolve some of the brittle alpha/delta eutectoid, which would account for the improvement in ductility. The improvements in ductility and pressure-tightness obtained on addition of lead to the 88/10/2 type of alloy are demonstrated in Table 3.

Summary

The best properties are obtained from castings possessing columnar structures and, therefore, the

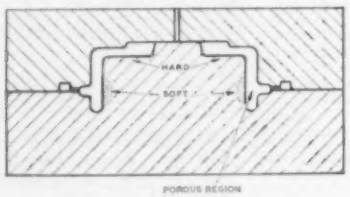
(*Continued on p.* 414)

Correspondence

To the Editor of the FOUNDRY TRADE JOURNAL

BRAKE-DRUM PROBLEM

SIR,—The problem of soundness in brake-drum castings posed by "Drummer" (JOURNAL, September 21, p. 346) is a serious one which has been experienced by a number of foundries making this type of casting. Experience at the British Cast Iron Research Association has shown that the cause of the defect is swelling of the casting which is usually favoured by lack of sufficient rigidity of the greensand mould.



A characteristic feature of the brake-drum mould is the sand cod usually produced in the drag half. When this is made on the type of machine described it is common to find that the top face of the cod has a mould hardness in excess of 70, although vertical faces may have hardnesses of only 55 or so. When this situation arises porosity may be found in the vertical walls of the brake-drum. This is illustrated in the accompanying sketch.

In our experience, the defect can generally be greatly reduced by ensuring improved hardness of the sides of the sand cod. This may be achieved by careful packing of the sand in this region and making sure that the moulding box is uniformly filled. Uneven hardness is generally favoured by sands which are unnecessarily tough or by the presence of cereal addition.

Sometimes soft cods are deliberately produced in order to facilitate lift, particularly when the pattern equipment is in poor condition, or to avoid scabbing, but such expedients may have been carried too far.

This problem has been found to be exaggerated by the use of ladle inoculants. Sometimes in foundries making the range of castings described by "Drummer" a single iron is required to make all the castings and this may have to be inoculated for thinner-section work to avoid chilling. In this instance raising the Carbon Equivalent and omtting inoculation would be expected to achieve an improvement in brake-drum soundness.

Much information has been accumulated on this subject and I would like to refer your correspondent to a paper* a colleague and the writer presented at this year's conference of the Institute of British Foundrymen, which deals with the problem. Yours, etc.

A. D. MORGAN

British Cast Iron Research Association,
Bordesley Hall,
Alvechurch, Birmingham.

* This paper has already been sent to "Drummer." Printed in the February, 1961, issue of *British Foundryman*, it was entitled: "Practical Observations on Mould Stability as a Factor in Controlling the Soundness of Grey-iron Castings."—EDITOR.

TECHNICAL EDUCATION OF FOUNDRY APPRENTICES

SIR,—The FOUNDRY TRADE JOURNAL is to be congratulated on giving pride of place in its issue of September 21 to the article on the "Technical Education of Foundry Apprentices." Mr. Callaghan's ideas, and indeed their execution at the David Dale College, are excellent and the article is a testimonial of what can be done by keen men, under adverse conditions, and with inadequate means. The new teaching foundry which is to be built at this College will, no doubt, have considerable effect.

It may be of interest to your readers to know that the Braintree College of Further Education is also in the process of building a very substantial and well-equipped teaching foundry and the opportunity has been taken to bring together representatives of companies spread over the East Anglian region, with a view to starting what is, to our knowledge, the first block-release course for foundry apprentices. They will spend five weeks full-time at the College during each of the three academic terms and would cover the full ordinary and advanced grade City and Guilds course in foundry practice in three years.

The Training Committee of the Council of Ironfoundry Associations has been consistently pressing for City and Guilds courses for foundry students to be held in adequately equipped college foundries and, indeed, for modifications to the present course so as to make it necessary to provide these facilities.

We believe strongly that our apprentices should be taught as foundry apprentices by specialist teachers and not in classes arranged as appendages to classes in other crafts. If this is to become reality everywhere, founders themselves will have to increase day-release to make classes of economic size.

In his hopes for a Craft Training Centre in Scotland along the lines of the National Foundry Craft Training Centre in West Bromwich, Mr. Callaghan shows his realization of the important distinction between industrial craft training for skill and the technical basis which it can be given at the technical colleges. This distinction is not always appreciated and founders sometimes expect colleges to do their work for them, particularly when they see the good facilities which some colleges provide.

One of the most interesting points in Mr. Callaghan's article refers to the increasing need for foundry technicians and as he says, the CFA and the Institute of British Foundrymen have been pressing for a new qualification of a higher national certificate level, and are still doing so. The success of the technical short courses such as those on "Foundry Metallurgy and Cupola Operation" and on "Moulding Materials, Moulding Machines and Defects" shows the increasing realization of managements that technicians and supervisors need more technical background knowledge to keep pace with modern conditions.

The shortage of qualified men, however, goes beyond that and is a direct reflection of the inability of the industry to attract a sufficient number of highly gifted young men. Having made proposals for the training of craft apprentices and technicians, the Training Committee is now considering the needs for recruitment, training and education of foundry technologists at the level of Dip. Tech., students and university graduates. Unless the industry is going to provide education and training facilities at all levels equivalent to those offered by other industries, it will fail to attract its fair share of the brains available and thus jeopardize its future. Yours, etc.

F. C. HAYES, *Education and Training Officer*
Council of Ironfoundry Associations.

American Grey-iron Foundry Industry

The following article is an abstract of the main points from a paper delivered to a meeting of the (American) Gray Iron Founders Society. The Author of the paper was Mr. Harry E. Figgie, Jr., partner of Booz, Allen & Hamilton, consulting engineers; his discourse was a report of an 18-month survey sponsored by GIFS. The comments in the paper were not confined merely to the grey-iron industry of America but tended to encompass all the country's basic foundry industries also. The paper dealt with three main points:—the general situation, key-industry problems and avenues of progress. It may be fairly stated that although it represents opinions expressed in America, some of the points made are equally applicable in the UK and other casting producer-countries. Indeed the Author could well have used the alliterative title: "Phrophet Predicts Poor Profits." Extracts from his discourse might also serve for foundrymen to send as propaganda to their customers.

In his opening remark to the GIFS meeting Mr. H. E. Figgie, Jr., referred to the general condition of the grey-iron foundry industry in America stating that from 1946 annual tonnages despatched by the industry had been relatively level at between 12 and 15 million tons. With relation to the gross national production, this meant that grey-iron castings had lost more than 30 per cent. of their logical share of the market since 1947. By comparing despatched tonnages rather than dollars, the inflationary monetary bias was eliminated and Fig. 1 showed clearly that the trend in grey-iron despatches had moved slightly downward since 1950, whilst both total machinery production and durable manufacturers had moved upwards. This, the Author stated, clearly indicated that grey-iron producers were losing their former share of the market.

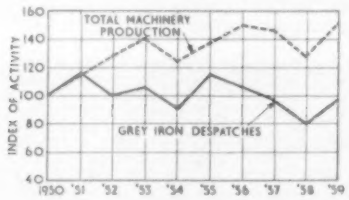


FIG. 1.—*Comparison of American grey-iron castings despatches in relation to total machinery production* (1950 = 100).

Major Problems

Mr. Figgie then listed the major problems which currently faced the grey-iron foundry industry as: (1) Lack of growth of the industry; (2) excess productive capacity; (3) small size of company units; (4) restricted geographical distribution; (5) increasing costs, and (6) ineffective management practices.

Lack of Growth

Dealing first with the lack of growth in the grey-iron foundry industry, the Author stated that a straight-line projection to 1965 of the tonnage requirements for grey iron came to roughly the same as produced in 1947. By contrast, the 1965 productive output of workers in the industry was expected to increase 88 per cent., almost double 1947. Such a productivity increase was essential, as the industry had been striving for increased profits—and a great deal of time, thought and effort had gone into improving methods, especially machine methods. Therefore, it was understandable that grey-iron foundries were experiencing a major trend in increased labour productivity. On the basis of statistical trends, the industry which in 1947 had 3,400 foundries and 174,000 employees should, by 1965, have only roughly 1,750 foundries and 77,000 employees.

It was not easy, the Author continued, to ascertain where grey iron was losing its tonnage, other than to aluminium. During the years 1950 to 1960, aluminium had shown a growth of about 40 per cent., although even to-day it still occupied a minor portion of the foundry industry, it had shown a definite upward trend. It could also be shown that the decline in despatches being experienced by the grey-iron foundry industry was closely paralleled by that of the steel industry and this indicated that in many cases the problems of the grey-iron foundry industry were not confined to a city, region, or even to the industry itself, but rather to the entire field.

Excess Productive Capacity

Another major problem which the industry faced to-day was excess productive capacity and this the Author dealt with next. He said that as long as the industry had this excess capacity, it would continue to have severe price competition and would continue to have too much money invested in assets—hence, a lower than average return on assets. This general situation was a definite deterrent to profits and progress and the subject of excess capacity was one which, in the Author's opinion, deserved a great deal of attention by the foundry industry as a whole. Much study and effort were called for in order to develop some type of solution to the problem.

American Grey-iron Foundry Industry

Influence of Size of Units

Another problem faced by the industry was the small size of the units in the grey-iron foundry industry and in the ferrous-foundry industry as a group. Here, the Author said that grey-iron foundries tended to be substantially smaller than either malleable or steel foundries. The average figure of about 96 employees (in the US) was somewhat high because of the influence of the larger foundries. The medium number of employees was 35 and this figure was considered by the Author to be more representative. Size, too, was a very important factor relative to profits, pricing and the future progress of the industry. In all sizes of foundries, from 20 employees upwards, the average number of employees per foundry decreased between 1947 and 1954. This decrease in numbers was definitely related to the productivity factor in the Author's opinion and served to indicate conclusively that foundries in all categories were actually getting smaller in terms of total employees. When one tried to relate the profit performance by size, it became quite clear that only the largest foundries consistently made money through good times and bad. Figures revealed that in a bad year such as 1958, as much as 87 per cent. of the total number of (American) foundries could be either unprofitable or only at a "break-even" point. Thus, only about 13 per cent. of the foundries tended to be profitable in both good times and bad.

Avenues of Progress

The Author stated that there were several avenues of progress and these he listed as improvement in profits, diversification and expansion of markets, but underlying all these was the need for a greater unified effort in the industry. An effort should be devoted to programmes for expanding existing and recovering markets lost to stampings, weldments, or other types of fabrications and which actually resulted in a higher cost to the consuming company. The lack of growth and lack of tonnage was a national problem which must be approached on a national basis and sometimes integrated with regional programmes to reverse the trend and raise the available market for commercial jobbing grey-iron castings.

Finally, the Author pointed out that foundries had not been able to spend the time nor the money and, in some cases, did not have the technical knowledge to do the necessary sales, engineering and educational work. This, he felt, emphasized the overall necessity of working together more closely as an industry and, in effect, underlined the theme of his contribution.

THE TIN RESEARCH INSTITUTE announces that "Soldeo Blando"—a Spanish translation of the book "Notes on Soldering"—is now available from its headquarters at Fraser Road, Perivale, Greenford, Middlesex, and from its offices in other countries.

Cross-Channel Freight Services

At a meeting of the Birmingham Chamber of Commerce on September 25 it was stated that the Chamber which is seeking better freight links with Continental countries in readiness for the possible entry of Britain into the Common Market, plans to urge British Railways to improve its special rail/ferry services across the Channel.

Mr. E. B. Ellis, chairman of the transport committee of the Chamber, reported that information about the experiences of manufacturers using the ferry services had been collated and it was clear that delays sometimes occurred because of the period of notice needed at present before wagons became available. The transport committee holds that in view of the substantial savings in packing costs by use of the ferry wagons (by which shipments are transported from manufacturers to their destination without the complication of re-shipment) it is highly likely that the scope for the use of the ferry service will considerably expand if and when Britain joins the Common Market. Time was usually an essential factor in exports to Continental markets and the Birmingham Chamber wants to ensure that delays in shipments are reduced to a minimum.

Research Laboratory in Massachusetts

A site in the Lexington Park section of Lexington, Mass., has been purchased by Kennecott Copper Corporation as a location for its new basic research laboratory. Here it is hoped to produce discoveries of a fundamental nature, and *inter alia* research will also be carried out to find the basic relations between electronic, atomic, and molecular structure to those of the macroscopic world in the form of physical, mechanical, electrical, magnetic and thermal properties of materials. Interim operations will be carried out in temporary quarters set up on the Lexington site at 114, Spring Street. Construction of the new laboratory is expected to take about a year.

How to Choose a Gunmetal

(*Continued from page* 411)

casting conditions should be adjusted as far as possible to produce this structure. 85/5/5/5 gunmetal is the best all-purpose alloy for thin sections, but the cheaper 84/3/8/5 gunmetal deserves to be more widely used where its somewhat lower strength can be tolerated. In thick sections, and in light sections where additional strength is required, the new 87½/7½/2/3 gunmetal can replace the 88/10/2 and 86/7/5/2 gunmetals with advantage. Finally, improved ductility and pressure-tightness, without loss of corrosion resistance, can be obtained in the 88/10/2 gunmetal by addition of about one per cent. lead. The properties of the new and existing gunmetals are summarized in Table 4.

REFERENCES

1. J. E. Stolarczyk, *British Foundryman*, 1960, **53** (12), 531.
2. F. Hudson, *British Foundryman*, 1961, **54**, 137.
3. A. Cibula, *Proc. Inst. Brit. Found.*, 1955, **48**, A73.
4. A. R. French, FOUNDRY TRADE JOURNAL, 1955, **98**, 281.
5. H. Reiter, *British Foundryman*, 1960, **53**, 128.

Equipment and Supplies

Flooring Material

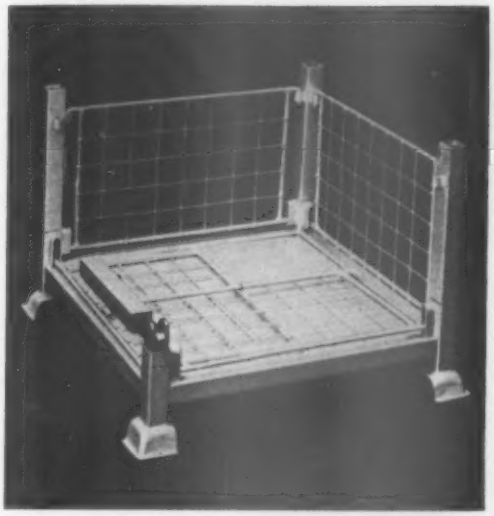
A Press reception was held on September 26 at the Bull Hotel, Birchwood, Swanley, Kent, by Burt, Boulton and Haywood, Limited, Belvedere, Kent, to introduce a new type of flooring material. Known as "Maximent," the material is reported to be the result of research and exhaustive testing by the company's surface-coatings division, its purpose being to provide industrial and commercial premises with a flooring material which will withstand the hazards which have hitherto made past surfaces impermanent and costly The material is a liquid dressing applied over a prepared base. The base consists of a screed of preferably 3:1 sand cement, properly laid and dried, then followed by a special primer. This takes a few hours only to set before the finish coat is applied and this, in turn, takes only a matter of hours to set before the area so treated can be in regular and permanent use.

The manufacturers claim that the material, at a usual thickness of only 1/16 in., provides a surface many times stronger and more durable than granolithic concrete. Other advantages claimed for the flooring is that it is waterproof, fire-resistant (remaining unaffected by heat up to 120 deg.C), is impervious to chemical attack, eliminates any problems of "dusting-up" and is therefore good for locations where it is vital for the air to be kept free from dust. The material can be supplied in a range of 12 colours and can be given glossy (but non-slip) or safety-grip surfaces.

Furnace for Melting Zinc Alloys

Lees Hall & Sons, Limited, Newhaven, Sussex, have designed and placed on the market a range of zinc-alloy melting furnaces, particularly suitable for use in the die-casting industry. The units are tangentially fired by a single forced-draught gas or oil burner and are fitted with a special type of flanged heat-resisting iron crucible. If required, the melting units can be arranged with automatic temperature control to ensure accurate programming without the use of skilled labour. Advantages claimed for the units are that they will give metal to specification, free from porosity and oxidation, minimum metal losses and rapid melting for maximum output. The furnaces are available in capacities from 100 to 4,000 lb. and central or lip-axis tilting furnaces can be arranged when required, for the feeding of further bale-outs or direct metal supply by chute into die-casting machines.

FIG. 1.—*One of the new Lees Hall bale-out zinc-alloy melting units installed at Wolverhampton Die-Casting Company, Limited.*



The collapsible post or box pallet, shown above, has been introduced in standard form by E. Stephens & Son, Limited, 58/66, Bath Street, London, E.C.1. It has an approximate height of 8 in. when collapsed which conforms to railway return travel requirements and permits stacking with other types of pallet. The posts, when erect, need no bracing, it is claimed, and a simple feature in the design ensures that the detachable sides will not come apart whilst travelling in the collapsed form.

Slide-rule for Pipes*

A special slide-rule designed by I. Alexander, of International Enterprises, and manufactured by Blundell Rules, Limited, Regulus Works, Lynch Lane, Weymouth, Dorset, is now available to provide accurately and rapidly the answers to three commonly recurring sets of calculations in connection with the weight and strength of pipes. The answers are given simultaneously in British, American and metric units, and can, it is claimed, be obtained in a matter of seconds.

One operation gives the weight of pipes made of steel, cast- or spun-iron, aluminium, bronze, copper, or lead, when the diameter and the thickness of the pipes are known. By a second operation, it is possible

* Account extracted from "Civil Engineering."

Equipment and Supplies

to determine the value of the bursting, test, or working pressures, the yield or stress point of the material required, or the outer diameter or thickness of any metal pipe, when the other three values are known. Finally, a further set of scales gives the relative carrying capacities of pipes of different internal diameter. The slide-rule can also be used for straightforward price calculations.

Dust Collector

Dallow Lambert & Company, Limited, Thurmaston, Leicester, have recently introduced the "Dalamatic" automatic fabric filter which was on show for the first time at the Heating, Ventilating & Air Conditioning Exhibition on September 26. The unit (Fig. 2) whilst employing limited quantities of compressed-air as a cleaning medium embodies the fundamental

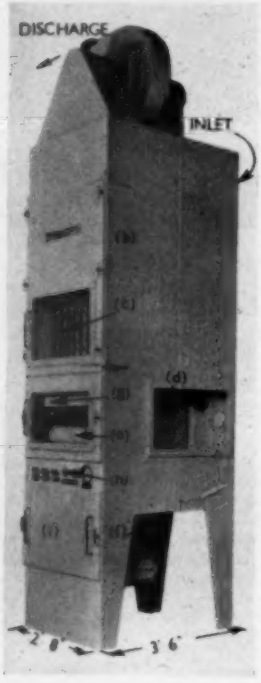


FIG. 2.—*Dallow Lambert "Dalamatic" automatic fabric filter. This particular model is the two-tier type complete with exhaust fan, rotary dust-discharge valve, and instrumention.*

KEY: (a) Exhaust-air fan; (b) air-inlet header; (c) compressed-air distribution manifolds; (d) expansion chamber; (e) solenoid valves; (f) hopper; (g) immediate used-air reservoir; (h) controls for fan, air-compressor and rotary valve, and (i) compressed-air regulator chamber.

dynamic air-flow characteristics generally associated with some blow ring-type filters, but has no mechanical moving parts. The maximum fabric area of a single unit is obtained by three tiers, giving at present, 180 sq. ft. of fabric. Multi-assemblies are capable of handling air volumes in the order of 100,000 cu. ft. per min. The filter elements consist of pad-type sleeves fitting over a specially-designed matrix and header and the filter media may be constructed in a variety of materials, natural or synthetic, woven or non-woven. Automatic cleaning of the filters is arranged by reverse-direction blasts of high-pressure compressed-air into the filter elements in controlled sequence, and the dislodged dust is deposited into a hopper. The contra-flow compressed-air delivery is of such limited duration as to avoid significant diminution in main air-throughput. Control of the compressed-air supply is effected by solenoid valves activated by a variable electrical-impulse controller, different frequences being used to suit different dust characteristics. Provision is made in the collector for continual assessment of filter and plant behaviour as a result of instrumentation incorporated within the basic structure.

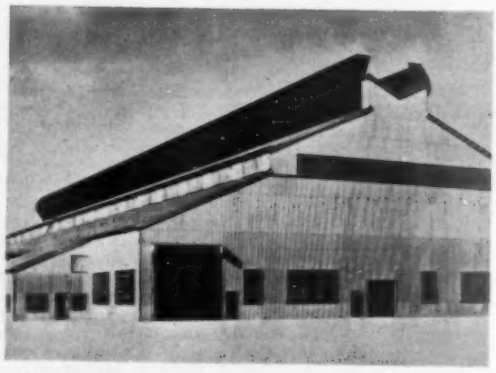


FIG. 3.—*Robertson Thain's "Giant" ventilator designed for quick extraction of exceptionally fierce heat or fumes.*

Ventilator

The Monitor, a "giant" ventilator 30-ft. wide (Fig. 3), recently introduced by Robertson Thain, Limited, Ellesmere Port, Wirral, Cheshire, has been designed for the "hot spots" of industry where quick dealing with fierce heat and fumes is essential, *e.g.* heat-treatment and die-casting buildings, furnace plant, etc. The ventilator is clad in proofed metal sheets and generally there are no moving parts to maintain. It is available in length to suit requirements and in several sizes.

Excavator: Moore's Plant, Limited, of 105/129 Markfield Road, Tottenham, London, N.15, have been appointed sole United Kingdom distributors for the new model T.Y.45 "Poclain" self-propelled hydraulic excavator. This machine is available with more than 30 alternative and interchangeable buckets and grabs for trenching, boring, loading, bulk excavation, skimming, re-handling and face shovel-work. It is reported to have a penetration force of up to 16 tons, a hydraulic pressure of 3,500 lb. per sq. in. and will excavate bore-holes of up to 17 ft.

Local Stocks: To improve deliveries to foundries in North-East England, F. & M. Supplies, Limited, are now storing many of their specialities in Newcastle-upon-Tyne. The firm already hold stocks in Manchester, Sheffield, Birmingham, and Glasgow, as well as in London.

FOR THE PRODUCTION OF INVESTMENT CASTINGS for aero-engines Incandescent Heat Company, Limited, (Cornwall Road, Smethwick 40), announce that Rolls-Royce have recently ordered their seventh furnace. In this unit, moulds weighing nearly 1 cwt. each, will be heated to a temperature of over 1,000 deg. C. before receiving the molten metal. They are carried through the heating chamber on heat-resisting trays, cast at the Incandescent group's Stourbridge foundry.

Heating and Ventilating Exhibition and Conference

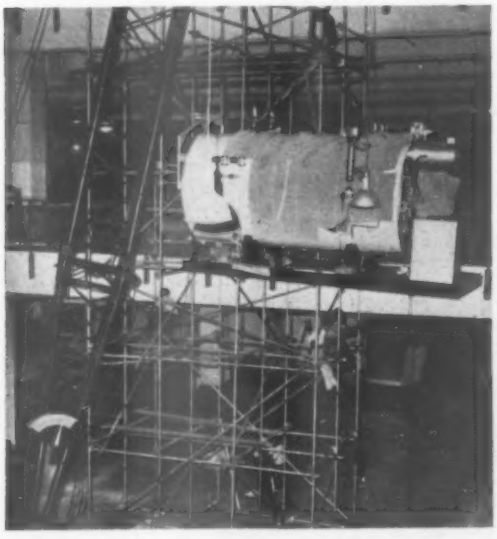
Delegates Visit Keith Blackman's

On Tuesday of this week, 100 delegates out of the 800 who are in London for the first international Heating, Ventilating and Air Conditioning Conference, visited the 10½-acre head office and works of Keith Blackman, Limited, at Tottenham, London, N.17. Over 40 per cent of the visitors to the conference are from overseas. Those who went to Tottenham were shown the methods adopted for the design, development and manufacture of the company's Tornado range of air moving and treating equipment, and in addition to the actual production shops, powerhouse and test-bed they visited the various research departments. Demonstrations were also given of the industrial gas-burning and control apparatus manufactured by the company. (Keith Blackman are exhibiting on Stand No. 18 on the ground floor of the Empire Hall, Olympia, at the current HEVAC Exhibition.)

* * * *

Allied Ironfounders at Exhibition

The task of raising this 8½-ton industrial boiler to the second floor of the Olympia presented a civil-engineering-sized problem at the Heating, Ventilating and Air Conditioning exhibition closing at the Olympia, London, tomorrow. Appearing on Allied Ironfounders, Limited's stand (205), *this boiler was manufactured by their subsidiary Frederick Kay (Engineering), Limited, and although they state that this is one of their smallest units it proved to be among the largest single exhibits in the HEVAC exhibition. The tower which had to be erected and used in conjunction with a 25-ton crane to swing it into position may be seen partly in the photograph below taken during hoisting operation.*



Industry in the Midlands

At the press conference following the meeting of the Midland Regional Board for Industry in Birmingham on September 26, Major C. R. Dibben, chairman, said that the industrial outlook for the Midlands as far ahead as the middle of 1962 will almost certainly be set by trends in October and November of this year. He said that the measures introduced by the Chancellor of the Exchequer during the summer were causing firms to review their stock levels and expansion plans. It was possible that these reviews would be reflected in time, even more strongly in fewer orders for machinery and equipment and building projects.

Many industries in the region were, however, maintaining a high level of activity. Capital goods manufacturers were busier, machine-tool firms had full order books and civil engineers were fully occupied. There was, nevertheless, less buoyancy in the steel industry, in the motor trade and in demands on the more expensive consumer goods. "Some steel producers have experienced a marked slackening in demand and some foundries and forges have been working below capacity," Major Dibben went on. "The railway-vehicle industry still faces the problem of dealing with an uneven and inadequate flow of orders and under-employment, and some short-time working exists in the car and motor-cycle industries." There was still a general shortage of skilled labour in the Midlands but the demand for unskilled labour had "eased considerably." The rate of unemployment in the region had risen from 1.1 per cent. to 1.4 per cent. between August and September.

Dinner

INSTITUTE OF VITREOUS ENAMELLERS

The twenty-seventh annual banquet of the Institute of Vitreous Enamellers was held at the City Livery Club last Friday, Mr. W. S. Grainger presiding. With him at the high table were Professor H. O'Neill, M.MET., D.SC., F.I.M.; Mr. M. J. Glenny, Mr. W. T. Wren; Mr. J. Nicholls; Mr. A. T. Green, C.B.E., D.SC., F.R.I.C.; Sir Charles Goodeve, F.R.S.; Mr. J. W. Gardom; Mr. J. Hooper; Mr. W. G. Pedder, and Mr. D. A. Richards. The president proposed the Loyal Toast, and other speakers were Professor H. O'Neill, Mr. Wren, Mr. Glenny and Mr. Nicholls.

French Engineers visit UK Steelworks

A trade mission consisting of over 20 senior representatives of the French steel industry are visiting Britain, this week, as guests of the Steel Works Plant Association, with the objective of studying recent developments in British rolling-mill and ancillary equipment. They will visit 10 plant manufacturers and steelworks in the Sheffield and Middlesbrough areas and in the Midlands. The party arrived on Monday last and will return to France on Saturday. On Monday, Her Majesty's Government gave a reception for the delegates at which Mr. Peter Thomas, M.P., Joint Parliamentary Under-Secretary of State for Foreign Affairs, was the host. Tomorrow (Friday) the visitors will be guests at a dinner given in their honour by the Export Council of Europe.

Personal

Mr. A. READ has retired from the board of Powell Duffryn, Limited.

Sir ALEXANDER SIM has been appointed a director of the Cementation Company, Limited.

Wolf Electric Tools, Limited, have appointed Mr. JOHANNES BUNDGAARD as sales supervisor of Denmark.

Mr. E. L. TUFF has been appointed deputy managing director of the Projectile & Engineering Company, Limited.

Mr. C. F. NEEDHAM, until recently southern branch manager of Hoover, Limited, has retired after 33 years with the company.

Mr. H. SMITH, chairman and joint managing director of British Ropes, Limited, has joined the board of the United Steel Companies, Limited.

Mr. ROBERT JOLLIFFE has been appointed sales director of the Standard Range and Foundry Company, Limited, with effect from October 2.

Mr. A. D. BAYNES, A.MET., A.I.M., has joined the North Eastern Iron Refining Company, Limited, Stockton-on-Tees, as chief metallurgist.

Mr. A. M. WELDON has resigned as a director of Millspaugh, Limited, and has been appointed by Mr. E. W. COLBECK as his alternate director.

Mr. FRANCIS JONES has been appointed managing director of Robert Harris, Limited, the metal pressings division of Villiers Engineering Company, Limited.

Mr. J. N. B. CARDWELL has been appointed a director of British Northrop, Limited, and has become managing director of its subsidiary, British Northrop Sales, Limited.

Mr. R. B. W. BOLLAND, formerly general manager of Head Wrightson Stockton Forge, Limited, has been appointed London manager of Head Wrightson & Company, Limited.

Mr. AUSTIN W. SCOTT has been appointed to the board of Armstrong Whitworth (Metal Industries), Limited. He joined the company in 1949 and continues as works manager of the Jarrow Foundry division.

Sir WILLIAM BLACK, chairman of A.E.C., Limited, has been re-elected president of the Institute of Road Transport Engineers, and Mr. J. H. VINCENT, technical officer of London Carriers, Limited, has been re-elected vice-president.

Mr. J. A. WILKINS relinquished the position of production engineer with the Stanton Ironworks Company, Limited, near Nottingham, on September 30, to take up the appointment of chief engineer with Henry Wallwork & Company, Limited, Manchester.

Mr. F. COX has resigned his position as deputy manager of Newton Chambers' foundries, Chapeltown, near Sheffield, to join the John Vickers & Sons, Limited, group, of Darlington, as general foundry manager of Newgate Foundry, Barnard Castle, Co. Durham.

M. S. C. COLLIS, who joined the Waterloo Iron Works as an apprentice fitter in 1911 and has been foreman since 1932 when the company became Taskers of Andover (1932), Limited, has retired. Presentations were made to him by colleagues and staff.

Mr. F. MARK RUSSELL, a director of S. Russell & Sons, Limited, engineers and ironfounders, of Leicester, has relinquished his position as secretary of the company and has been appointed engineering divisional manager. Mr. J. B. FOGGETT succeeds him as secretary.

Mr. C. R. BAMFORD has retired from the firm of George Salter & Company, Limited, West Bromwich, after 54 years with the company. For more than 40 years he made heavy springs and latterly has been engaged on the inspection of balances and machine-shop parts.

Mr. JOHN T. LEWIS has been appointed a director of Staveley Industries, Limited. Upon his appointment to the parent board, he has relinquished his directorships of two Staveley group companies, Bradley & Foster, Limited, and the Birmingham Chemical Company, Limited.

Dr. DENNIS S. BEARD has been appointed to the board of Griffin & George (Sales), Limited, as technical sales director. Dr. Beard joined the Griffin & George organization last year from the Norwich City College where he had been a lecturer on physics and mathematics.

Dr. W. J. BATES has joined R. & J. Beck, Limited, optical instrument makers, etc., as chief engineer, and pending completion of the company's new factory at Watford will be located at Lister Works, Dickenson Street, London, N.W.5. Dr. Bates was previously at Bristol University.

Mr. LEONARD H. SHORT, director of overseas operations, English Electric Company, Limited, has been elected chairman of the Export Panel of the British Electrical and Allied Manufacturers' Association. Mr. HAROLD P. MARTIN (sales director of C. A. Parsons & Company, Limited) is the new vice-chairman.

Sir DONALD PERROTT has been elected to the board of Cammell Laird & Company, Limited. Sir Donald has also become chairman of the Patent Shaft Steel Works, Limited, in place of Mr. P. B. HUNTER, who has relinquished that position due to pressure of other business interests, but remains on the board.

The Minister for Science has appointed two new members to the Advisory Council on Scientific Policy for the period ending July 31, 1964: Sir WILLIS JACKSON and Sir ALAN WILSON. Sir Alan Wilson is deputy chairman and managing director in charge of research and development, Courtalds, Limited.

Mr. CHARLES O. EDWIN, who has for the past 15 years been with BSA Motor Cycles, Limited, latterly as northern-area representative, has been appointed sales manager of Norton Motors, Limited, Birmingham. He succeeds Mr. W. J. SMITH, who joins Associated Motor Cycles, Limited, Plumstead, as general sales manager for AJS and Matchless machines.

Mr. W. H. SHARP, managing director of Thomas Smith & Sons (Rodley), Limited, left Britain by air on September 30 on a prolonged tour of Smith distributors. His places of call include Johannesburg, Perth, Adelaide, Melbourne, Sydney, Brisbane, New Zealand, Singapore, Kuala Lumpur, Delhi, and Calcutta. Mr. Sharp hopes to be back in Britain early in December.

Mr. S. STANSFIELD, deputy chairman of Oxley Engineering Company, Limited, has been elected to the board of De Vere Holdings, Limited. Mr. B. C. MORTON has resigned as deputy chairman and managing director of Robert Dempster & Sons, Limited, and Mr. Stansfield has been appointed in his place. These changes follow the company's policy to integrate the engineering companies in the De Vere group. Robert Dempster & Sons and Oxley Engineering, while collaborating closely on technical matters, will continue to trade as separate companies.

SECTION DEVOTED TO THE TECHNOLOGY OF PRODUCING DIMENSIONALLY-ACCURATE CASTINGS

European Investment Casters' Conference

Technical and Social Activities of the EICA in Florence.

The eighth event of its type, the Conference held in Florence in September attracted 80 delegates from 10 countries. Some 21 representatives attended from UK investment foundries and were prominent both in contributing papers and in the discussions which took place on a wide range of topics. What follows is a general account of the proceedings, contributed by the JOURNAL'S own representative who attended the Conference.

On the invitation of Italian investment founders, the venue for the eighth Conference of the European Investment Casters' Association was the City of Florence, from September 11 to 13, all the technical meetings being held in the rooms of the *Associazione degli Industriali della Provincia di Firenze*, (Industrial Association for the Province of Florence). Here, well-appointed meeting rooms, refreshment rooms, etc., were placed at the disposal of the Conference. Mr. Meerkamp van Embden (of the Philips concern in Holland) was Conference chairman and attendance totalled over 80 delegates, many of whom were accompanied by their ladies, more than 20 representatives of British firms being present.

General Programme

Members travelled independently to Florence and for accommodation were scattered in various hotels. The first function was an informal gathering on Sunday evening, September 10, at the Hotel Villa Medici. Here, delegates and their wives were greeted by Mr. and Mrs. Meerkamp and also by Mr. L. Camatini (Microfusione Italiana S.p.A.) representing the Italian hosts. Over cocktails and light refreshments, delegates rediscovered old friends and made new acquaintances and this informal occasion thus provided an admirable stepping-stone for the Conference deliberations and social events which were to follow. It was at this gathering, also, that Conference documents were handed over, in addition to gifts of silk scarves to the ladies and illustrated guide-books and maps of Florence, all presented by Microfusione, whose personnel had put so much into the organization of the Conference. In addition, each member received a good-sized name-badge, a folder of tourist information, street plans, guides, particulars of places of interest, general and cultural information about the city. An analysis of the list of male participants to the Conference showed that in addition to the party from England and one each from Austria and Canada, Germany provided the second largest delegation of 20, other figures being France 10, Netherlands 9, Sweden 6, Spain and Switzerland 4 each, and America 5.

The Conference programme recommenced on the following morning with a formal opening ceremony, followed by technical sessions over the rest of the morning and afternoon, while the ladies were engaged in a sightseeing coach tour. That evening was free for the ladies, although there was the annual business meeting lasting until 6.30 p.m. for the menfolk. Technical sessions occupied the whole of Tuesday between the hours of 9 a.m. and 4 p.m. (apart from normal breaks for coffee and

Group of UK delegates attending the informal reception which inaugurated the Florence Conference of the European Investment Casters' Association last month. From left to right are Mr. W. K. Davy (P.I. Castings (Altrincham), Limited); Mr. L. S. Taylor (G. L. Willan, Limited); Mr. W. N. Jones (Deritend Precision Castings, Limited); Mr. G. A. Tomkinson (D. Napier & Son, Limited), and Mr. I. L. Gwynn (P.I. Castings (Altrincham), Limited).

Scenes at the opening ceremony held in the premises of the Industrial Association for the Province of Florence. Addressing the meeting is Dr. B. Bearzi who gave the inaugural lecture; on his right is Mr. P. Turchetti (Microfusione Italiana), and on his left, Mr. H. J. Meerkamp van Embden, the chairman. Seated in the front row of the audience (left to right) are Mr. R. M. Cook (Inco (Mond), Limited) and Mrs. and Mr. L. S. Taylor.

lunch). From 4 p.m. to 6 p.m. on that day there was staged a Quality Contest and Castings Exhibition—now normal features of these Conferences—followed later that evening by the annual banquet, also held in the Hotel Villa Medici. Wednesday morning saw further technical sessions up to the official closing ceremony at noon, although quite a number of delegates and their ladies stayed on for luncheon together, followed by a visit to the art foundry of Fonderia Marinelli during the afternoon.

No fewer than 18 technical papers were presented and discussed during the proceedings and when it is remembered that Florence was still basking in very hot sunshine, it will be realized that concentration on such a congested programme was quite arduous.

Opening Ceremony

The opening ceremony was held in a cool-marble-flagged assembly room with groyned ceiling —a welcome contrast to the hot sunshine outside. Each seat for the delegates was equipped with earphones and a receiver set with dual plug points was arranged between each pair of seats. Simultaneous translation of the proceedings was arranged in French, English and German. The rear of the dais consisted of a large painted map of mediaeval Florence and made quite an impressive and colourful backcloth. Each speaker had an individual microphone and a blackboard and screen was on hand for use by the various lecturers. In addition, there were projectors at the side of the dais for the showing of slides and films, the translators' booths being arranged at the rear.

Welcoming delegates and their ladies to the Conference, Mr. Meerkamp first made particular reference to the ladies saying how pleased he was to see so many present. Florence, he said, was a jewel of a city and a place of pilgrimage for investment casters because of its association with Cellini and the lost-wax process, bearing, as it did, the stamp of early foundry techniques and artistry. He thanked the Italian hosts for their organization of the Conference and spoke then in Italian. The purpose of the Conferences held by the European Investment Casters' Association was co-operation, he said, and for discussions and the interchange of experience and ideas. He recalled the first Conference held in Paris when all present were strangers and said how much that had changed now. They were now continuing the fight to establish investment-casting as a production process, first in the field of better foundry techniques and alloys and secondly, by the adoption by industry at large of these better products. Mr. Meerkamp then welcomed particularly the delegates from the US who, he said, had travelled a great distance to be present, and also gave a welcome to other delegates. Before calling upon Dr. Bruno Bearzi to open the Conference officially, Mr. Meerkamp said that he had received apologies from Mr. R. Waindle (of the US) and from Mr. P. Mathy of Belgium who said how sorry they were not to be able to participate this year.

Historical Art-foundry Background

Opening the Conference, Dr. Bearzi (the celebrated historian and restorer of statuary and monuments), speaking on behalf of the Industrial Association of the Province of Florence), said that his hobby was to study old methods and thus he was very interested in investment castings. He referred

for example to the recent discovery of cast-bronze "masterpiece" statues in Piraeus which he had examined. It led him to wonder how the excellent standard of workmanship was achieved so many centuries ago. To indicate the standard of work achieved, some of it carried out several centuries BC, Dr. Bearzi showed the audience a small sample and said that he had found composite assemblies of large cast pieces which had been achieved by "burning-on" techniques. The knowledge of how to make such castings had then been transferred to Rome, and at that time it must be remembered that no cores were used. Soon after, however, even equestrian statues were produced but 2-mm. thick in parts. Then in the 12th century and during the Renaissance in Italy, foundry crafts were re-developed and Dr. Bearzi made particular reference to Andrea Pizzaro's door which weighed 10 tons. The 16th century saw the first contracting art foundry established in Florence, and examples of the work produced were the Ghiberti doors, with their remarkable gold-faced cast panels. After tracing the development of investment casting up to the present day, Dr. Bearzi said that present studies into the process and materials had continued such work using new materials.

Mr. Meerkamp then thanked Dr. Bearzi for his inspiring and interesting talk and said that one difference with ancient and present-day work was that ancient foundrymen expressed more "poetry" in their work.

Before the proceedings closed and the ladies left to go on their sightseeing tour, there was a short time available for questions and in reply to a question from the floor, asking if old castings contained zinc, Mr. Meerkamp said that he knew craftsmen of old used lead in art castings for example, but were careful to exclude it from armament castings. Dr. Bearzi also contributed to this matter, saying that the history of art alloys could be classified as follow: In Greece, the 90 per cent. Cu and 10 per cent. Sn alloy for the most part was used and this alloy was also used during the Renaissance, and even up to the first world war. The Romans on the other hand had substituted Pb for Sn and some castings were made with only 1 to 2 per cent. Sn and 14 per cent. Pb. Silver was an incidental impurity in art castings at that time. Going into the history of the early alloys, it was found that some early bell castings were spoiled by the accidental inclusion of silver because it caused cracks. Nowadays, analysis enabled forgeries to be detected, *e.g.* there was no nickel in genuine antique bronze because nickel was a relatively new element. It must be absent from old bronze but was always present in modern alloys—if only as accidental contamination! The final speaker at the opening ceremony was Dr. G. Somigli (president of the Italian Metallurgical and Foundry Association) who referred to links between old and new methods and finally welcomed delegates to the Conference and wished it every success.

Annual Banquet

The annual banquet of the Conference was held on the Tuesday evening at the Hotel Villa Medici, which was understood to have been converted from the luxurious home of a prominent Italian cabinet minister. The whole of the delegates and their ladies attended this function, in addition to a number of guests, the total assembly numbering approximately 130. Before dinner was served, Mr. Meerkamp van Embden welcomed the gathering and proposed a toast to the Italian hosts, which was warmly supported by those present, and Mr. Aherne Heron (of Trucast, Limited) proposed a toast to Mr. Meerkamp, "Our President."

Also at the opening ceremony, Mr. Meerkamp van Embden (Philips Gloeilampenfabriken, Eindhoven, Holland) is shown welcoming delegates. On his left are Dr. G. Somigli, president of the Italian Foundrymen's Association, and Mr. L. Camatini (Microfusione Italiana).

Diplomas won in the castings competition held during the Conference were presented to the winners during the banquet by Mr. Meerkamp. For the casting showing the widest scope for the investment process, the diploma was presented to Mr. Valenta, of Cercast Inc., Montreal, and on handing it over, Mr. Meerkamp said that he could surely say *veni, vidi, vici!* to which Mr. Valenta jokingly replied that it was perhaps some consolation that he was European by birth! Speaking German, Mr. Meerkamp presented the diploma for the "best casting of the year" to Dr. E. G. Nickel, of Deutsche Edelstahlwerke AG, Bochum, Germany, who made suitable reply. Finally, addressing his remarks first in French, Mr. Meerkamp thanked the Italian hosts for their hospitality, mentioning Mr. Camatini in particular. Professor Bearzi replied on behalf of the Italian hosts, speaking first in English and then in French, and wished success to the rest of the Conference and expressed the hope that delegates and their ladies would take home with them pleasant memories of Florence. The whole function was informal and the enjoyment of the evening was assisted by the absence of after-dinner speeches.

(Accounts of the technical sessions and competitions to be printed shortly)

BICTA Annual Conference Proceedings

Discussion of Papers presented

Of the series of papers presented to the third annual Conference of the British Investment Casters' Technical Association (BICTA), held in the Connaught Rooms, London, earlier this year, three have so far been published in the recent consecutive monthly issues of the JOURNAL. Discussions of these papers have now been made available and lengthy abstracts are given in the following. Appropriate footnotes direct the reader to the issue of the JOURNAL carrying the parent article. When publishing the other papers read at this Conference it is hoped that it will be possible at the same time to append the relevant discussion.

During the third technical session of the Conference under the Chairmanship of Mr. R. W. N. DANIELSEN (Deritend Precision Castings Limited), the paper "The Control of Product Quality"† was presented by Mr. F. Nixon, B.SC.(HONS.ENG.), M.I.MECH.E., F.R.AE.S., M.I.PROD.E. (Rolls-Royce Limited) and the following discussion took place.

Mr. I. L. GWYNN (P. I. Castings (Altrincham) Limited) opened the discussion by commenting on the more provocative statements which had been made in the paper. It had been indicated that quality control in this country was practically non-existent. There had also been one or two other controversial remarks which he was sure foundrymen present would want to answer, as he did believe that in all their activities they were practising quality control to some degree according to what the customer required. Nevertheless, the paper had been very refreshing in that it clearly defined and emphasized what the speaker considered to be, perhaps, one of the most important aspects of their activities. As an example of the magnitude of the problem, Mr. Gwynn recalled that some time ago his firm had sent a batch of castings out, and inadvertently the scrap was mixed up with the good castings, but they had a record of the percentage scrap which they had rejected. They put the problem to the customer and said, "Send us back any castings which you consider are not to your standard," and they received back about half the ones which they had scrapped, so the other half were acceptable.

He was also convinced when he had read this paper that Mr. Nixon had so written it that it would be almost impossible to question him on it. It was all very much in general terms. Nevertheless, he had a question or two.

Capital Cost

It was stated that over-all running costs of quality control could approximate to 10 per cent. of the gross sales. He wondered really at what cost this was in capital outlay, because he was convinced that to achieve the standard which this paper envisaged there would have to be some comment on capital outlay. Secondly he assumed that the investment foundry at Rolls-Royce (from which Mr. Nixon dissociated himself) was primarily concerned with the Rolls-Royce Company's domestic requirements so it meant virtually that the foundry had only to satisfy one customer. Quality control, as Mr. Nixon defined it, must be influenced by the customer's requirements. He therefore asked how he would achieve the right degree of control for, say, many hundreds of customers, and an even greater number of individual components.

On the question of scrap, his firm he recollected had on one occasion calculated so many scrap castings at so much each and found out how many thousands of pounds that amounted to in a year, and, so realized the size of the problem. He asked whether this was the point at which to start before attempting the salvage, or avoidance, of scrap.

Visual Standard

Mr. NIXON dealt with the first point concerning the customer who accepted half of the scrap. On his experience the inspection of castings was an extremely difficult problem, because so much of it was visual and quite often there was a very-high percentage of rejections. When there existed a visual standard, one was asking the inspector to exercise a great deal of judgment on each piece which he looked at, and it was inevitable—particularly where the scrap percentage was high—that there would be haziness as to the dividing line between good and bad. This led to a continual struggle between the man who had made the castings and the inspector. The former could always find one or two castings which ought not to have been rejected, but he was careful not to look for those, probably equal in number, which had been accepted wrongly.

With regard to costs, he wished to make it clear that he was not talking about the running costs but about the total cost. The total cost of quality assurance included the costs which were ascribed to the incoming raw-material control, the tooling for inspection, inspection wages and salaries, and the charges on the space occupied by the inspection and quality control section, as well as the cost of scrap and rework. Capital outlay would depend very largely on the kind of product. In the invest-

† Published in the JOURNAL July 6, 1961, p. 15

ment foundry industry, capital outlay would be required for mechanical testing, laboratory equipment and consumables for analysis, in the penetrant check, and in the X-ray film, and so on. Capital outlay depended on many things; including the rate of production and the kind of product, and there was no simple answer to it.

Slow Inspection Methods

On the machining and casting side of industry productivity of the processes for producing dimensions far exceeded the productivity of their measurement, and so something had got to be done by inspection people to try and keep up with production. The inspector still had his old-fashioned ways of measuring. A casting bore many dimensions which could not always be checked by gauging, and it appeared that there was much scope for research and development into methods of measurement.

He agreed that the first thing to do, was to find out what the scrap was costing the company and very often the cost could be reduced considerably by quite simple means, once the figures were known. It was when the rough had been taken off that one had to become more systematic about the whole thing.

MR. D. MORRIS (Birmingham Small Arms Company, Limited) continued the discussion by saying that Mr. Nixon had helped the industry to get the question of inspection, or the relation between inspection and production, into the correct prospective. However, he could not agree with the author entirely when he said that there was no quality control, although whether it was anything to do with the quality the customer wanted or their own interpretation was another matter.

He was very interested to see that Mr. Nixon had mentioned cost. He believed it was Henry Ford who had said that anything that could be drawn could be cast. Unfortunately he had omitted the important point of cost, and the economic cost to the customer was a very important point.

Specification

In this quality control business—he found it very difficult to establish the specification. As a supplier to Rolls-Royce, who were one of their customers who gave them a specification to which to work, it was quite refreshing to have that specification. It was quite difficult to meet it at times, but at least they knew where they stood. Often it was a case of going to talk it over with the customer who did not know what he wanted—he had a very hazy idea which he put on the drawing—the casting must be free from blowholes, etc. Although statistics were a very important part of business management Mr. Nixon had pointed out that statistics themselves needed analysing before they could be usefully used as an aid to business management.

Mr. Nixon had been very controversial in his remarks as far as the technical components of the industry were concerned. He would like him to remember that the art of casting illustrated was a very-old casting. It was not known how long it took the founder to produce that casting, or at what cost it was produced, and Mr. Nixon no doubt realized quite well that this industry was a relatively young industry which had grown up because of the high cost of labour and overheads in the manufacturing industry compared with very-heavy costs now involved in very-complex machines. That was where the investment casting industry came in with close-form castings.

Mr. Morris then posed a final question concerning what sort of authority Mr. Nixon would give a quality-control engineer, and to whom would he be responsible in the organization for setting up and working a quality-control department.

MR. NIXON replied first to the question of specifications saying that he would like to say that they might be very difficult to meet but were far more difficult to write.

On the question of the youth of the industry, he said that he was extremely well disposed towards the casting industry and founders. He only wished that they would get a move on. However, there was one risk here. There had been a tendency in some foundries of late—this applied to some designers as well—to expect too much of the founder and parts which ought to be fabrications were being put into foundries. In their desire to try and please everybody the foundries were trying to undertake these jobs. It was important to realize the scope and limitations of the process—and every process had limitations.

Responsibility

On the question of authority, he wanted to emphasize again that there was no single universal solution. It was important that the quality engineer should not be responsible to the production engineer, and also important that the inspection department should not be responsible to the production department, unless its manager was pretty high up in the organization and could balance output against quality in his own mind. As to whom the quality engineer should answer, depended very much on the size of the organization and set-up. He could very well report to the chief engineer or chief designer or, as in his own case, to the chief executive. It depended so much on the abilities, outlook and time the chief designer had to spare. If the chief designer had tended to become very much a chair-borne character, knowing less and less about how things were made, then he ought not to have anything to do with the quality-control. If one had a good old-fashioned firm then some form of quality control, unrecognized as such, was probably being exercised by the chief engineer. He was afraid, therefore, that he could not give a precise answer to that question.

MR. A. DUNLOP (Jessop-Saville, Limited) commented that in the past, he himself had been associated with Rolls-Royce foundry, when Mr. Nixon was involved with it. During that time the chief executive once said that any fool could scrap a casting, the good inspector was the man who could pass it and say it was good enough for the

job. On this basis the inspector should not be paid according to what he rejected but to what he said was good enough.

He then asserted that there was a well-known aircraft company—not Rolls-Royce—who was now producing and using very successfully, cast turbine blades which were performing much better than forged blades, a matter which he hoped had not missed the Chairman's notice.

Scrap Criterion

MR. NIXON answered that concerning the business of scrapping castings, he had said in reply to the two previous questioners that it was extremely difficult to write a specification. So often a specification had to be written which accepted castings of which they were thoroughly ashamed, but which they thought might work. Scrap was so high that they had to accept at least some of them, and because castings in these various alloys could be subject to so many different defects it became extremely difficult. When so many of these were visual defects which had to be assessed and judged by the inspector, it was quite a difficult task. Those who wrote the specifications and the inspectors themselves became quite dizzy in trying to interpret specifications.

On the question of cast turbine blades, he had been pressing for these for many many years. He was glad to hear that they were coming through at last. He had always said that eventually materials would be so good in their heat-resisting properties that they would become unforgeable and that they would then have to cast blades.

The CHAIRMAN intervened to add that they too had known about these cast blades for some time, and had always thought that they would eventually be cast, and that was why his company had never made them as forgings.

MR. J. AHERNE HERON (Trucast, Limited) asked Mr. Nixon what he considered to be the permissible rejects by his company on inspection, because if the purchaser rejected nothing and the manufacturer rejected it all then it must mean that the manufacturer was probably keeping back, within his own scrap, products which would be acceptable to the buyer. One was therefore faced with the problem of dual inspection which was one of the greatest difficulties which existed. The manufacturer inspected products before they left and the purchaser inspected products when they arrived and it almost appeared necessary to have a third party present to determine how good was good enough.

On the question of cast versus forged blades, testing was still a good method of inspection, but they still had not got a first-class non-destructive method for testing castings.

Permissible Rejects

MR. NIXON replied that the speaker had better disabuse himself about the best being not good enough for aircraft. If the best were not good enough there would be no aircraft flying. The whole crux of quality engineering in the aircraft industry lay in determining how bad was good-enough—that is, what was the lowest standard that could be acceptable. There had got to be a tolerance on everything and this tolerance had to be determined. Some people simply said that the job must be perfect, but nothing was perfect if it was studied sufficiently. One could always show up with the microscope, the hand glass or the magnetic test some defect previously undetected, so one was always having to find out what was good enough. Therefore, his company was having to carry out quite a lot of fatigue testing in order to find out what was the lowest safe standard. The reason why development engineers and designers were often not interested in this problem was that they lived in a world of prototypes which meant one off, two off or three off. Production people, on the other hand, lived in a world of hundreds and thousands off, where the problem of variability arose. This was where one had to have a tolerance and determine which was the worst one which it was safe to use. It was not a question of not being good enough, it was a question of how bad it could be.

On permissible rejects, this was one of the major difficulties in the field of stressed castings. Scrap was usually fairly high, whereas machine-shop scrap was usually of the order of 2, 3, or 4 per cent., and it was usually something which was measurable and positive. With castings, so much was visual or visual aided by a penetrant, and it was awfully difficult to assess these methods. That was why it was possible for differences to arise between the supplier's and the receiver's inspectors or a third party. He had been through this himself, and consulted three, four or five people down the line. They had all disagreed over the odd little fringe, and he thought that one had to accept that there would be a fringe of argument where some inadequate parts were being accepted and some adequate parts which were above standard were being rejected.

On non-destructive testing, there was a good deal of work going on. Many people said that the methods available were far-too good, and there had been times when he himself had wished for an "invisible" penetrant.

Economics

MR. R. WAINDLE (WaiMet Alloys US) said that his own paper was going to be something on the same lines, except that it was approached entirely from the technical standpoint. One of the interesting things, which Mr. Nixon had brought up several times, was the economics of this. In his own country the manufacturer tended to fall back on the justification for poor quality control, that it cost him money and the customer would not pay for it. They were fortunately getting away from this conception, at least in some instances. The International Business Machines Company had recently presented a paper at a casting conference sponsored by the US Government, in which they

showed how they used quality-control methods to evaluate their vendors. They awarded points on the basis of the amount of scrap they found, *i.e.*, the percentage of rejects they found in their inspection department against the vendors. They rated the vendor up to number 15, so that number 15 vendor was the very-best quality vendor. If his price was 15 per cent. over a non-rated vendor he got the job. In other words what the International Business Machines Company had done was to put quality control on a statistical basis in rating the vendors to the point that made it worthwhile for the vendor to have good quality control in his own plant.

In reply to the CHAIRMAN'S invitation to propose a vote of thanks, MR. D. C. JARMAN (de Havilland Engine Company, Limited) thanked Mr. Nixon for his very excellent paper and the very fine way in which he had presented this rather difficult and very controversial subject.

FOURTH SESSION

At the fourth technical session, under the chairmanship of MR. W. FOYERS (H. & F. Precise Castings, Limited) the paper entitled "Dynamic Accountancy"* was presented by MR. E. A. EDE (Deritend Precision Castings, Limited) and an account of the discussion which followed is given below.

MR. W. S. FOWKES (H. & F. Precise Castings, Limited) said that he fully endorsed the view which Mr. Ede had expressed in the paper, that accountants in industry should be used by management, not merely as historians and recorders of past events with their consequent effects on the company's finances, but as major aids in making history by virtue of their skill and ability to provide the means and information which properly presented and utilized should play a big part in fashioning future levels of production and types of activity which could be undertaken.

Standard Costing

Mr. Ede had in fact generalized on these various points, but most of those present were really concerned with the application of these thoughts to investment casting. He strongly suspected that Mr. Ede in this paper took standard costing as a means of amplifying his theme, since this was the most-extensively-operated costing system in the engineering field to-day in one form or another. He then asked whether the author really considered standard costing, whether in a rigid or modified form, the best method for the industrial accountant of an independent producer of investment castings.

The question was posed in view of the fact that the independent producer would find it difficult to prepare sales forecasts, for instance. A sub-contracting industry generally did not manufacture products but depended on its own marketing ability and the skill of its salesmen. From the point of view of production, it was his experience that so little was standard in investment casting that it was very difficult to apply the yardsticks which were mentioned in the paper, and parallels referred to. Each job had to be considered on its merits and many changes were often necessary even after bulk production had commenced, owing to the many variables associated with investment casting. In view of these basic difficulties, he asked whether Mr. Ede favoured a standard-costing method for investment casting, or a carefully designed accumulative costing process where costs were built up progressively as the castings proceeded along their production journey, and the cost of scrap which was a very important factor, assimilated in the cost of the good production at various suitable stages.

MR. EDE replied that he would hesitate to advocate that someone in the questioner's position should put in a system of standard costs, certainly to the elaborate extent which was common in the conventional machine-shop assembly type of engineering company. He thought that the absence of a reliable sales forecast was a very-major stumbling block to start with on a standard cost and budgetary-control system.

"Desk Management"

MR. G. L. WILLAN (G. L. Willan, Limited) stated that it was quite evident that Mr. Ede had a clear insight into the problems facing not only the accountant, but also the management. The speaker had some experience of the impact of accountants on industry, and he had been somewhat worried when he had seen them in control. However, there was a comment of Mr. Ede's at the end of his paper which he should like to quote, "Figures are a guide, not a substitute for looking." Really the heart of the paper was in this. There was a great danger, in what the author referred to as desk management. Where management tended to divorce itself from what he called the looking aspect of their business, one could usually anticipate danger signals. The prime responsibility of management was undoubtedly to make a profit and accountants can give management a tremendous amount of guidance to achieve that end, but the formulating of the policies which go to the making of that profit must be in the hands of the management and not of the accountants. He had this particularly in mind because he felt that many developments—which ultimately proved to be successful developments—would not have been proceeded with if a decision to initiate those developments had rested solely on figures presented by the accountants. In many of these cases they would indicate—and let us be quite emphatic about it—that a loss was bound to occur. Probably a loss would occur for a time, but ultimately by this judgment, successes could arise from ventures where the accountant could definitely prove that failure was all that one could expect.

In view of the very practical and down-to-earth aspect of Mr. Ede's paper, he proposed asking about the timing of the presentation of accounts to management. He had discussed with acquaintances in other concerns how often they had accounts presented to them. Some said they got

* Published in the JOURNAL August 3, 1961, p. 139.

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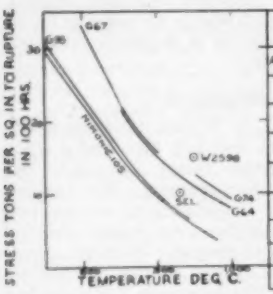
by with their annual audited accounts, some said quarterly accounts, some monthly, and some said they never bothered about accounts at all, and they usually seemed to be the successful ones. He asked Mr. Ede what he considered to be the optimum timing for the presentation of accounts to management.

Mr. EDE replied that, on the timing of accounts, he could not advocate more strongly that the proper timing for accounts was monthly in almost all circumstances. He thought monthly accounts produced to management about the 10th or 12th, or something of that date in the following month was as near perfection as one could get in this wicked world. He had heard of some people presenting accounts weekly, and believed that at one time in between the wars the Austin Motor Com-



COMPOSITION					
ALLOY	G.67	G.64	G.55	SEL	Nimonic 105
C	·10	·10	·15	·08	·13
Cr	16·0	11·0	15·0	15·0	15·0
Mo	3·0	3·0	4·0	4·5	5·0
Ti	1·0		2·5	2·4	1·3
Al	6·0	6·0	2·5	4·5	4·5
W	4·0	4·0	2·0		
Nb		2·0			
Co				26·0	20·0

FIG. 1.—*Properties of Vacuum-cast nickel-base alloys compared with wrought Nimonic* 105.

pany did so. He thought that it was a symptom that they were in such sad straits that they had to be right on top of everything to the minute, and a week was as near as one could get. He considered that this was rather an exaggerated form and was not applicable except in particular circumstances, but a month had everything to recommend it. First of all, a month was a normal sort of period of time. One thought of May, June and July as months in which things happened, and he considered an accounting period should relate naturally to it. From the point of view of expediency, if one had quarterly or half-yearly accounts, these occasions caused a tremendous disturbance in the accounts department. The staff started working overtime, and the ordinary routine was disorganized. There were things which fell into a normal weekly cycle. The wages department worked round Friday to Friday. On a Friday morning or afternoon or some such time, the insurance cards were stamped, the clock cards were collected and a start was made on next week's wages. In the same way with a monthly statement, books were closed and the accounts prepared. It was a natural cycle. Anything else tended to be a sort of major crisis and because it was produced in a sort of crisis atmosphere as something special the ordinary work went by the board and the accounts took far longer to prepare than should have been necessary From the practical point of view again as to when they were produced—which he considered would be about a month or six weeks after the end of the period in the case of semi-annual accounts—they could not be a lot of use to the management. The accounts were perhaps for the six months ending June, but something may have gone wrong in the second week in January. There may have been excess consumable stores usage or excess labour and requisitions. He considered it bad enough trying to get the average factory supervisor to recall something which occurred five or six weeks previously, but to start asking him about something which might have happened six months previously was absolutely impossible. Again, if monthly accounting was presented at the end of the year, very little extra work was entailed. He would not hesitate; he would say monthly for almost every company and for special cases at more frequent intervals; but certainly not less frequently than monthly.

Accountants' Caution

Mr. Willan spoke of being rather frightened of accountants' attitudes towards new developments. He sympathized because he thought accountants must naturally tend to be conservative; if they were not by nature then they would soon become so at an early stage of their training. He would be rather horrified at the idea of a wildly-enthusiastic accountant in his own office as he considered that the major task of the accountant was to damp down the more wildcat schemes of expansion which arose. The ones which were really sound and solid would get by him by sheer persistence. He could only chop off the highest weeds and the others would flourish, and this was probably the way it ought to be.

Mr. R. TAYLOR (Firth-Vickers Stainless Steels, Limited) commented on the reference to labour efficiency and labour turnover with the reasons given for labour terminations. There were so many reasons for termination which were not necessarily the truth that it was very difficult to give a true picture. He asked how Mr. Ede would arrive at and assess the rate of labour turnover and express it as a percentage; the normal procedure being the total intake divided by the total labour force to give a percentage.

Mr. EDE replied that this was exactly the short method which he had in mind.

FIFTH SESSION

At the fifth session, under the Chairmanship of Mr. N. WALKER (Hadfields, Limited), a paper entitled, "Recent Developments in Alloys for Gas Turbine Rotor Blading"* was presented by Mr. E. GLENNY (National Gas Turbine Research Establishment). An abstract of the ensuing discussion is reported below.

* Published in the JOURNAL September 7, 1961, p. 293.

Mr. D. R. Wood (International Nickel Company (Mond), Limited) stated that he considered it was very important that Mr. Glenny had drawn their attention to the fact that air-cast alloys had not been completely neglected in the headlong rush towards highly-specialized materials which were complex and involved vacuum treatment, both in the manufacture of the stock and in the production of castings, though, of course, many foundries were putting in equipment to deal with this sort of material. It might be of interest that alloys such as EPE10 represented an attempt to make heat-resistant high-nickel alloys without those useful but troublesome hardening elements, titanium and aluminium. Alloy EPE10, was just a start in a field of development of a new class of alloy which could be handled perfectly adequately in air. At the present time, however, the available evidence was that this class of alloy could not expect to reach to the highest levels of properties which had been shown possible for the titanium-aluminium type of nickel-based alloy. Therefore, foundries who were contemplating the installation of vacuum equipment could perhaps take heart from this. This was an observation from the known information available.

Notch Fatigue

The other point referred to was the question of notch sensitivity in fatigue to which Mr. Glenny had drawn attention in his paper. He implied that alloys of low ductility might be suspect from a notch-fatigue point of view, and he made the point in addition that this could be dangerous in moving parts which were subject to the impingement of foreign bodies, perhaps in a turbine. One would, of course, support this and the statement must be true as a generalization.

He referred to the wrought Nimonic alloys which had their important parts to play in the turbine, and which had at least, provided the mother, if not the mother and father, of most of the alloys which were referred to in the paper. If one considered the tensile elongation of the three Nimonic alloys 80A, 90 and 105 it was found that room temperature tensile elongation values were respectively 40, 30 and 10 per cent. In a creep test lasting about 100 hours, the creep-rupture elongation was about 1 or 2 per cent. for the first alloy; it was a little higher for the second; and higher still for the third. In notch fatigue, one found that Nimonic 80A and Nimonic 105 were less sensitive to notches than Nimonic 90. The conclusion drawn from this was that one must be careful in deducing from short-term tensile or from longer-time creep tests what the actual notch-fatigue sensitivity was likely to be. Nothing was known about the cast alloys from this point of view. He asked Mr. Glenny to comment on what he really felt was the importance of notch fatigue. He considered that most of those present agreed that designers did—or they should—avoid notches at all times, and suppliers tried to avoid them in the production of their components, whether cast or wrought. The notch was a symptom of failure perhaps on the part of the designer or manufacturer. It certainly was not intentional in the finished engine. Therefore, he asked whether it was really felt that notch sensitivity in fatigue was of great importance, or was it the ordinary sensitivity under fatigue conditions which was of importance.

As far as he was aware, the only specifications which called for notch-fatigue minimum limits were for components such as bolts. Speaking on behalf of the founders, he hoped that the day was a long way off when specifications called for anything in this direction. The warning was, however, thoroughly fair.

Mr. Glenny thanked Mr. Wood for his comment

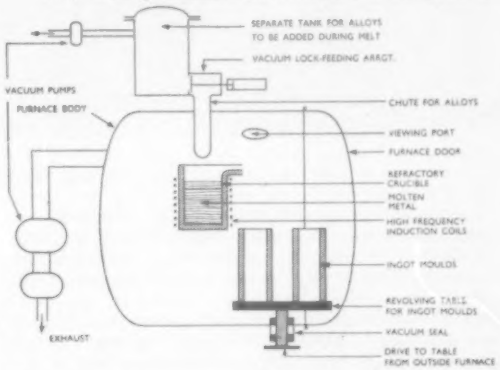


FIG. 2.—*Diagrammatic sketch of high-frequency vacuum-melting unit.*

and said in reply that with regard to the question of notch fatigue, the only comment one could make was that one avoided notches in the blades prior to putting them into service, but one often could not avoid the introduction of notches in the surface by accidental causes. The reason that notches were of importance was that most of these alloys had a low ductility, and therefore the presence of the notch really reduced the induction period required for cracking. This applied not only to ordinary fatigue but to thermal fatigue as well. In the thermal-fatigue test, particularly, the test could be divided into two phases. First, there was the induction period in which it took a certain number of cycles to develop a crack which was only a few thousandths of an inch in depth. After this microscopically-visible crack was obtained, crack propagation proceeded at the normal rate. If there was a notch present at the beginning, a shorter induction period existed. The same remarks applied to mechanical fatigue, although he had no experience of mechanical fatigue testing of notched specimens.

MR. A. DUNLOP (Jessop-Saville, Limited) stated that he wished to highlight one or two of the points made in the paper and quoted the following paragraph:

"Recently, however, the rupture strength advantage of cast over wrought alloys coupled

FIG. 3.—*Two 600-lb.-capacity high-frequency vacuum-melting units.*

with the compositional control afforded by vacuum melting had encouraged Bristol Siddeley Engines, Limited, to use a cast nickel-based alloy (G64)[6] in the first-stage rotor-blading of Proteus engines."

Also quoted were the running hours which had been built up, 100,000 hours, and the engines had done getting on for 3,000 hours without failure.

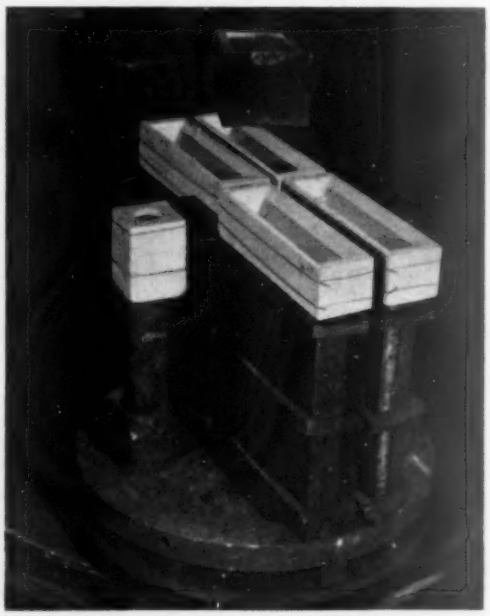
Vacuum Melting

It was rather unfortunate that this meeting clashed with the Institute of British Foundrymen's meeting at Cheltenham for there Mr. Tedds of Bristol Siddeley Engines was presenting a paper on the production of these blades and it was a great pity that the paper had not been presented at this meeting as well. He stated that he would like to add a little to this sort of development which was being done on the higher properties of these cast blades and on the need to use, and the results of using, vacuum practice for both consistency of composition and for consistency of the casting. Referring to Fig. 1, he stated that these results had been obtained some little time ago and the experimental composition number W 2598 had been investigated considerably further. Stress-rupture data was available over a range of temperatures. It was gratifying to report that the curve ran parallel with the G74 line, showing that its properties were all superior over the particular range of temperature. The alloy, Nimonic 105, was one of the more-highly-developed wrought alloys, and the others were cast alloys of a similar type. G55 was finding quite wide application for cast rotor blades. G64 had been in service now for quite a considerable time, and many thousands of blades have been cast from it. G67 was a slight modification on G64 at a higher-chromium content, as shown in the reported analysis. As Mr. Glenny had indicated in the paper, the corrosion resistance of some of these low-chromium alloys was improved considerably by a protective coating.

Consistent Results

Table 1 showed the consistency possible by the use of vacuum-melting techniques. The first analysis reported—labelled Master Melt—was of the G64 material, which was from bar stock. They had also cast creep-rupture specimens with each melt and the pass test was a duration of 50 hours. This sample had been taken off after 60 hours. The

FIG. 4.—*Close-up of ingot moulds in the casting unit.*



five other casts were individual melts made from that master melt, and he considered that everyone would agree that the compositional variation was within analytical error. He did not know of any other way in which they could get this consistency of results other than by using vacuum techniques. Fig. 2 showed a diagrammatic sketch of an HF furnace for producing vacuum stock. The tank at the top was connected by a vacuum valve so that alloys might be added during the melt. During the process of melting the ingot moulds were located in the turntable in front of the pouring furnace and indexed for filling. Fig. 3 was a view of two 600-lb. units. The one that was closed on the right was melting down, and the one on the left had been opened for ingot moulds to be removed Fig. 4 showed the turntable with the ingot mould for producing bar stock. The little mould on the left was a creep-rupture test-piece mould. These moulds were indexed under the fixed pouring basin in front. Fig. 5 showed the bar stock manufactured. The smaller-diameter bar at the top was for arc-melting units and the larger one for HF units. Because of the need for creep testing and expensive testing generally there were obviously economic and technical advantages in making a bigger master melt. So although these 600-lb. furnaces were very acceptable, they were in the process of installing a one-ton unit. Fig. 6 showed the vacuum melting chamber just being squeezed through the door of the melting shop. This was for a one-ton unit.

Grain Structure

MR. L. S. TAYLOR (G. L. Willan, Limited) stated that he would be interested to hear what Mr. Glenny had to say on the effect of crystal shape and size on properties of thermal fatigue.

MR. E. GLENNY regretted that he could add very little to these comments because the National Gas Turbine Establishment had not yet carried out a study of correlating thermal-fatigue behaviour with the grain structure of cast alloys. The only indications available were fairly superficial ones, but it appeared that the columnar-grain structure was not a good thing because the interdendritic material between the columnar grains was running in a direction parallel to the path which the crack would take. The interdendritic material was invariably weaker and less ductile than the material of the dendrites themselves. Generally, he was of the opinion that columnar-grain structure was not a good thing, but he could not comment on the optimum grain size and shape.

MR. L. S. TAYLOR then asked if it was Mr. Glenny's intention to investigate the effect of grain shape and size on thermal fatigue.

MR. E. GLENNY said that NGTE intended to extend the work to cast alloys. For wrought alloys the findings were related to the composition, and, in general were more or less what one would expect. A coarse grain gave quite-low thermal endurance and a fine grain size high thermal endurance. There was no linear relationship, however, and an intermediate grain size sometimes gave optimum endurances. For a sintered alloy of similar composition to Nimonic 90—sintering

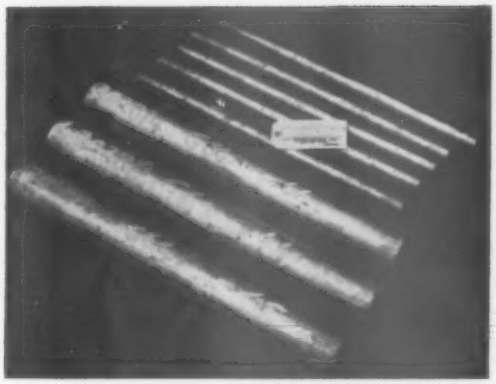


FIG. 5.—*Vacuum-melted bar stock.*

was used because it was fairly easy to vary the grain size by high-temperature solution treatment—it was found that over a range of fairly-coarse grain size (0.18 to 0.08 mm. dia.) the endurance progressively increased. The slope of the grain size/endurance curve tended to decrease from 0.08 to 0.05 mm. (ASTM 4 to 6) grain-size structures. Certainly, structures which had a coarse-grain size in general had a low thermal endurance, but it was not always possible to blame the coarse-grain size for the low thermal endurance. In some of these complex wrought alloys, in endeavouring to obtain a coarse-grain size, one inevitably altered the structure in other respects. So all one could say was that low thermal endurance was associated with coarse grain size rather than directly due to it.

FIG. 6.—*Melting chamber for 1 ton high-frequency vacuum furnace.*

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Mr. A. G. MASON (Deritend Precision Castings, Limited) mentioned that the recently issued second part of BS 3146 contains two alloys of the general type referred to in the paper. The only mechanical property requirement included in this specification at the moment was cold-tensile properties. They all realized, that the information obtainable from these tests was very limited indeed, and he wondered if Mr. Glenny could let them have his views as to what the ultimate specification requirements in terms of mechanical properties were likely to be for this class of alloy.

Mr. GLENNY replied that this was a rather difficult question because it must obviously depend on what the application was. In certain applications a high-rupture strength was not necessarily a basic essential for the application. For example, for nozzle guide vanes, a high rupture strength was not a basic essential, but it might be important to have a certain minimum level of ductility, and this was the reason for specifying the hot-ductility qualities. However, if one intended using Nimocast 90 for rotor blades he would not be content to accept the cold-tensile properties as a criterion and he would certainly want to see the rupture-strength values. He might even want to see some sort of guaranteed level of mechanical-shock resistance, again depending on the operational conditions, but certainly he would want to see rupture-strength values if the application demanded rupture-strength criteria.

Other Uses

Mr. H. J. MEERKAMP VAN EMBDEN (Philips' Gloeilampenfabrieken) asked whether the high-strength alloys were used only in the aircraft industry, or had they already also been introduced into other fields.

Mr. E. GLENNY stated that he would only answer this briefly for it was much better for the people who made the alloys to reply. The short answer was that they were not confined to the aircraft industry. They were used in the production of small gas turbine rotors for example, in motor vehicles.

Mr. A. DUNLOP (Jessop-Saville, Limited) added that in non-aircraft parts some of these alloys were proving very acceptable as extrusion dies.

Mr. D. R. WOOD (International Nickel Company (Mond), Limited) agreed that an established use for a number of these alloys was in turbo-charger rotors for diesel engines, and this had been going on for many years.

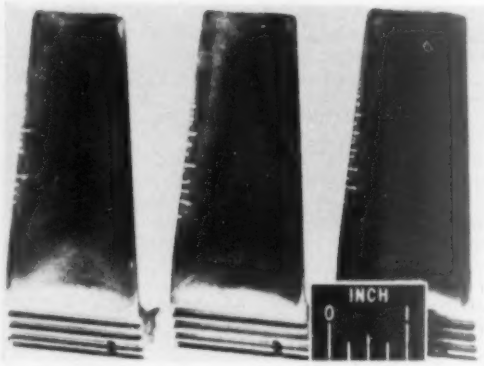

FIG. 7.—*Thermal-fatigue cracks in J47 turbine rotor blades. (Courtesy NASA)*

Mr. A. DUNLOP asked if he could comment on the grain size question. At the moment, if grain size had to be altered it was possible to do so. Techniques were being worked out whereby it was possible to control grain size in these cast alloys.

Thermal Fatigue

Mr. E. GLENNY then showed some slides related to one feature of the paper, *viz.*, thermal-fatigue behaviour. Fig. 7 showed a rotor blade of an American J47 engine which contained thermal-fatigue cracks in the leading edge produced by repeated starting of the engine, not repeated hot starts but simply repeated normal starts. These cracks were produced at between 10 and 50 cycles of starting, according to the alloy. They were quite fine cracks, outlined with a dye-penetrant and

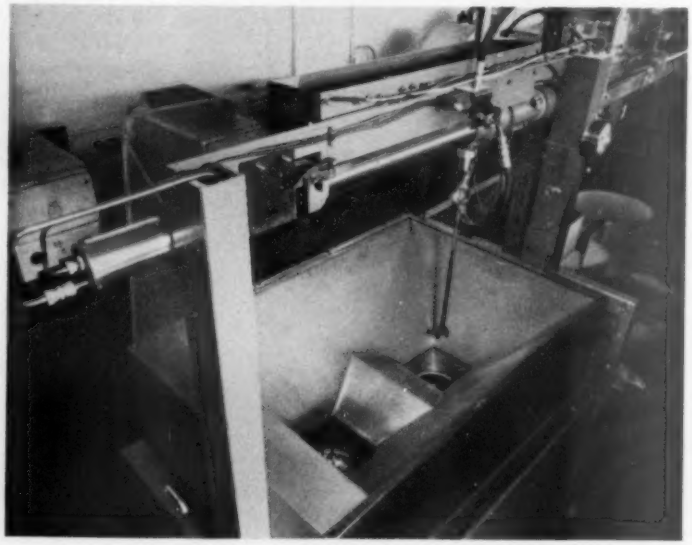

FIG. 8.—*Laboratory thermal-fatigue test equipment.*

chalk, and once formed, could propagate either by fatigue or creep, according to the characteristics of the engine. If the ratio of alternating to steady stress was high, propagation would probably be brought about by fatigue; whereas if the ratio was low they would tend to propagate by creep. This highlighted the point made that thermal fatigue was becoming a problem for rotor blades. It always had been something of a problem for nozzle-guide vanes, but now similar cracking was occurring in rotor blades, due to the tendency to use hotter engines. Fig. 8 showed the equipment used for thermal-fatigue testing in the laboratory. The equipment simply consisted of two fluidized beds, one hot and one cold. The fluidized bed was simply a bed of granular material supported on a permeable plate, and if air was passed up through the permeable plate the particles dispersed and the bed became fluidized, *i.e.*, it assumed some of the characteristics of a fluid. The fluidized bed had the advantage of exhibiting a very-high heat transfer rate for the quite-small amount of air mass flow needed to fluidize it. Thus was available a simple method of obtaining high heat transfer rates in the laboratory without the expense, noise, or any of the other disadvantages associated with high-velocity gas streams. The cold bed was maintained at room temperature by external water cooling, and the hot bed heated by an element fitted snugly against the inside of the container wall. The specimens were simply alternated between one bed and another in an up-across-and-down movement so that the time of transfer was of the order of about one and a half seconds between the beds. The immersion time in each bed could be varied independently. Instead of a cold bed one could have a warm bed if it was desired to adjust the temperature difference between the beds to suit particular test conditions. Fig. 9 showed the tapered-disc specimen used in this work, it being simply a disc a little bigger than a half-crown, actually $1\frac{1}{8}$-in. diameter, 0.275 in. in thickness, with a precisely machined edge, 0.010-in. radius. This was rather finer than the trailing edge of most turbine blades. The particular view showed the kind of radial cracks which developed purely by thermal cycling between 920 and 20 deg. C. Fig. 10 showed the comparative nature of the cracking obtained in Nimonic 90 by varying the top temperature of the cycle. In one case using an upper cycle temperature (T_2) of 920 deg. C., the endurance was 50 cycles to the first observed crack and the failure was intercrystalline, the type

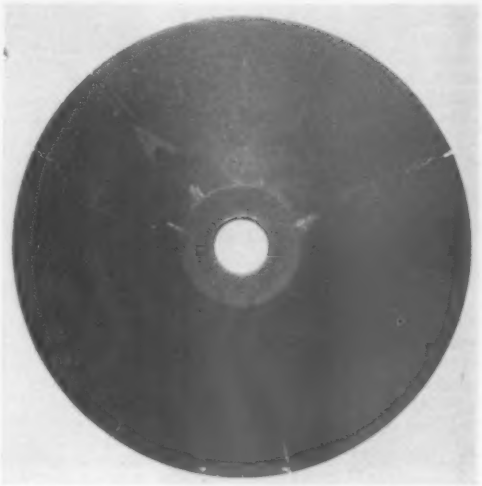

FIG. 9.—*Thermal-fatigue cracks in tapered disc specimen on Nimonic* 90.

normally associated with creep failure. In the other case, the T_2 value was 770 deg. C., and the endurance was 4,000 cycles, resulting in an intercrystalline failure of the kind normally associated with fatigue. The short-life intercrystalline crack was definitely associated with a significant plastic strain per cycle; in the T_2 770 deg. C. test, the plastic strain per cycle was quite small and therefore resulted in a typical fatigue type of crack.

Ductility and Fatigue

Mr. G. F. SMITH (Hadfields, Limited) asked if there was any relationship between room temperature ductility and thermal fatigue.

Mr. GLENNY replied that they had not found one so far. He thought that it depended on the type of test being carried out. In the particular type of test described, there had been a rapid-heating and a rapid-cooling cycle, and the rapid-heating cycle produced initial compressive stresses which resulted in yielding and a shortening of the edge. This occurred within the first few seconds before the interior had time to heat up appreciably. As the interior became hotter and expanded against the edge it tended to put the edge into tension, and therefore one obtained tensile strains near

TABLE 1.—*Reproducibility of Vacumelt G64. Nickel-base Alloy.*

Melt.	Chemical analysis.									Hours to rupture at 900 deg. C. 15 tons per sq. in.
	C.	Mn.	Si.	Cr.	Mo.	W.	Nb.	Al.	B.	
Master melt ..	0.11	0.27	0.47	11.12	3.11	4.0	2.05	6.0	0.26	60 unbroken*
Casting A ..	0.11	0.28	0.49	11.16	3.14	3.81	2.02	5.98	0.25	180
,, B ..	0.12	0.28	0.52	11.20	3.14	3.85	2.02	6.1	0.26	190
,, C ..	0.12	0.28	0.50	11.16	3.12	3.80	2.01	6.1	0.23	238
,, D ..	0.10	0.28	0.49	11.20	3.12	4.0	2.01	6.1	0.25	225
,, E ..	0.11	0.28	0.41	11.16	3.12	3.87	2.01	6.1	0.25	192

* Specification 50 hrs. minimum.

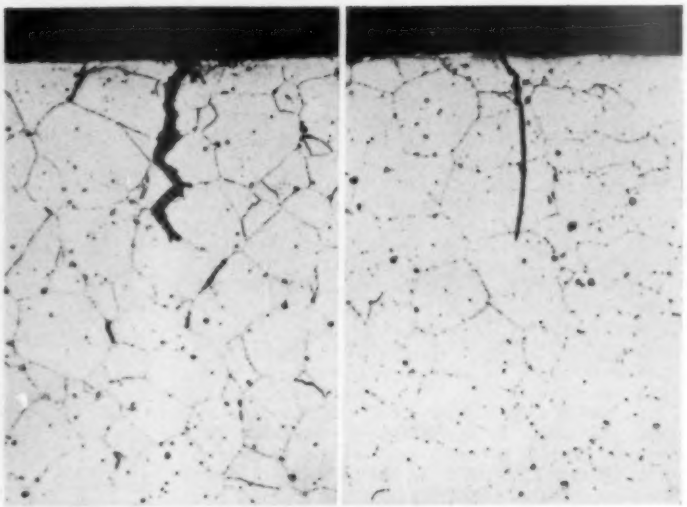

FIG. 10.—*Variation in the nature of thermal-fatigue cracking with upper-cycle temperature. Nimonic 90 standard discs, h and c, T_1, 20 deg. C. (Left) Intercrystalline, T_2 920 deg. C., (right) transcrystalline, T_2 770 deg. C. Magnification X 150.*

the top temperature of the cycle where one would imagine that high temperature ductility was important.

It had been shown conclusively that repeated heating was much more damaging than repeated cooling for wrought nickel-based alloys. In another type of test involving slow heating and rapid cooling the tensile strains would be developed at some temperature near room temperature, in which case room-temperature ductility could be important. As far as the thermal-fatigue problem in aircraft gas turbines was concerned, however, he thought that the room-temperature ductility was of lesser importance than the high-temperature ductility. One point which brought this out, for example, was the very good thermal endurance of the cast alloy G.64 at T_2 920 deg. C. The room-temperature ductility of this alloy was poor compared with wrought alloys, which exhibited lower thermal endurances at T_2 920 deg. C.

Coated Alloys

MR. R. WAINDLE (WaiMet Alloys, US) stated that they were doing a good deal of work with coatings in the United States, and he asked if anything had been done in testing these alloy coatings, and the effect of coating on thermal-shock resistance.

MR. GLENNY replied that NGTE had only done a limited amount of work on materials which had been coated and tested for thermal shock and thermal fatigue. From what little work they had carried out, a chromized coating did not improve the thermal fatigue resistance of an alloy of the Nimonic 90 type. Aluminized coatings tended to improve the thermal-fatigue resistance, but one had to be a little careful in making deductions in this instance because the heat-treatment associated with the deposition of the coating preparation could improve the thermal fatigue behaviour of the material in addition to the effect the coating had. Allowing for that, he would say that aluminizing tended to improve thermal-fatigue resistance.

MR. R. WAINDLE stated that there had been some very extensive work done on the coating of X40 with aluminized materials where thermal-fatigue resistance had been increased by two to two and a half times, and yet an alloy of that kind was not as susceptible to improvement by heat treatment.

MR. L. S. TAYLOR (G. L. Willan, Limited) asked if Mr. Glenny could indicate whether the test piece used in the thermal-fatigue tests was cast-to-size, and what machining had been necessary to form that particular shape. As mentioned earlier, both grain shape and service conditions could have a quite considerable effect on the results obtained. In Table 10* of his paper, Mr. Glenny had compared the thermal-fatigue properties of wrought and cast alloys. Unfortunately, there was not a comparative cast and wrought sample of the same specification. He asked if the author could generalize as to whether cast alloys were better, worse, or comparable with wrought alloys, in resisting thermal fatigue. Also what was the usual mode of failure, if there was such a thing, for high-temperature high-speed cast rotors. Recent experience had shown failures occurring in regions of highest stress, not in the regions of highest creep stress.

MR. GLENNY replied that the test specimens were cast slightly oversize, the "envelope" for machining being about 0.005 to 0.010 in. This was essential because the edge radius was quite critical as far as thermal endurance was concerned, and if one wanted to test a range of alloys with different shrinkage or contraction allowances one would get a variable edge radius if they were tested in the as-cast condition. They had not tested any materials of the same composition in the cast and wrought form but plans had been made to do so. As to the usual mode of failure of centrifugally-cast rotors, he stated that it was not too surprising that they failed at the bore because this was the most-highly-stressed region, and being the most massive region, almost certainly the properties of the bore were inferior to the properties at the rim. Unless one was quite careful, particularly about the design as well as the feeding characteristics, one was likely to run into failure of the bore.

* FOUNDRY TRADE JOURNAL, September 7, 1961, p. 300.

Raw Material Markets

Iron and Steel

In all sections of the ironfoundry industry overall production of castings is at present well below capacity levels and there are no signs of an improvement on these demands in the foreseeable future.

The steelworks also have reduced appreciably their usage of castings and although most of the engineering and speciality foundries maintain a five-day working week, many find it difficult to do so with the present amount of work on hand.

Although current outputs of basic pig-iron are on a reduced scale, these are still more than sufficient to satisfy the demands from the steelworks. On account of their reduced ingot production which at present is about 78 per cent. of capacity, their usage of pig-iron has been on a declining scale for some time, and this has resulted in the closing of some furnaces and the curtailment of outputs at other units producing the basic steelmaking pig-iron.

The foundry grades of pig-iron are in easy supply and consumers are able to obtain all the tonnages they require without difficulty. Fairly good demands continue to be made for the low phosphorus irons by the engineering and speciality foundries and they are also absorbing a fair amount of hematite and some refined iron. The high phosphorus iron is in much better supply than the demand for this grade.

There is little if any improvement in the demand for most of the products of the re-rollers. Reinforcing rods and bars continue in good demand, but there is only a moderate call for small bars, light sections, and strip from home consumers, and export business is difficult to come by on account of the strong competition from makers abroad.

The call for mild steel semis from home steelworks continues much lower than it has been for a long time past and they could increase deliveries appreciably if the call warranted. Carbon steel semis are also in good supply, and alloy steels can be secured more easily. There continues a good demand by the re-rollers for suitable defectives and crops which become available at the steelworks.

Non-ferrous Metals

The uneasy feeling about business prospects in the UK and Europe combined with lesser optimism of the outlook in the United States has led to a general weakening of all the major non-ferrous metals. Copper in London is under the influence of the general malaise and is showing little resistance to going towards lower levels. In the US the market is holding up quite well and the price of 31 cents a pound by both producers and custom smelters is being maintained, although the intake price for scrap has now fallen to 25¾ cents a pound.

Tin is tending to mark time in front of the meeting of the International Tin Council in London on Monday. It is believed that two of the most important questions to be discussed will be whether there is to be a new price structure and whether the United States will become a member. Many people are looking for a ceiling price of £1,000 a ton and the fact that this is in doubt has caused some hesitation in the market.

At the same time plans are going ahead for the disposal from the Canadian and Italian stockpiles of about 4,000 tons of tin which should help to bridge the gap between production and expected consumption. Meanwhile the US price is moving narrowly around $1.21 a lb. and the London spot price is fluctuating rather widely on either side of £945 a ton.

Lead is inactive and the market is unreceptive to sales, the outlook is still bleak and the price is not much above £61 a ton. In the US the market is quietly steady and the quotation unchanged at 11 cents a pound.

Zinc has come under considerable pressure in London due to the sale of metal from Russia which has been in the warehouse for some time. It is said that the metal was relatively high grade which usually commands a premium, but it was offered at ordinary GOB prices. In consequence the London price has fallen below £72 a ton.

Book Review

Standard Boardroom Practice. Prepared by a special committee under the chairmanship of Sir Edwin Herbert. Published by the Institute of Directors, 10, Belgrave Square, London, S.W.1; price 12s. 6d.

If this book were to carry a sub-title then the reviewer suggests that it should be "Underlying Ethics" because throughout it is stressed that the directors are the trustees for the proprietors of a company—that is the shareholders. Obviously, the board has other concerns, such as its duty to employees, its customers and to the State. In its discussion it must bear all these matters in mind—a matter forcibly presented in Chapter 1 of the book. The question of profits is next considered and these of course belong to the shareholders; but it is for the directors in their wisdom to decide as to the actions to be taken as to their disposal, always of course in the best interest of the proprietors. After this follow two sensible chapters on shareholder and employee relations in both of which is stressed the importance of giving the maximum permissible information about what is happening to the company. The customer and the creditor are next dealt with. Chapter 6 is interesting and important as it concerns take-over bids. Many of these appear to result from inadequate disclosure of real assets in report and balance sheets. There are in addition a number of other considerations and these are lucidly set out. They should be carefully studied by the boards of small successful companies.

The next chapter deals with the individuals making up the board from the chairman downwards, but it is the name of "managing director" which comes in for most criticism. In the view of the committee, this title is misleading, and some companies have discarded it in favour of "directional general manager" or "management director," because it is the function of the chairman to manage the board, whilst the chief executive is responsible to the board. The final chapters cover directors' pay; business expenses; the accounts, and donations for charitable and political objects.

A foreword is by Viscount Chandos who, like the reviewer, believes the book to be of real interest to those whose work it is to control the destinies of limited companies.

V. C. FAULKNER.

TO DEMONSTRATE THE CHARATERISTICS and uses of their corrosion-resisting alloys, Henry Wiggin & Company, Limited, are staging a "Fight against Corrosion" Exhibition at Londonderry House, Park Lane, London, W.1, during October 10 and 12. A series of lectures and films is also being arranged. Tickets are obtainable from the sales department of the company at 20, Albert Embankment, London, S.E.1.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated. Prices following side headings marked* are subject to an increase of 1 per cent. under Iron and Steel Board Price Determination, 1961, No. 2.)

October 4, 1961

PIG-IRON

*** Foundry Iron.**—No. 3 IRON, CLASS 2, 10-ton lots or over, Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

*** Low-phosphorus Iron.**—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham; £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

*** Hematite.**—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over: N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; South Wales (Welsh iron), £23 19s. 0d.

*** Basic Pig-iron.**—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £45 0s. 0d. to £48 0s. 0d., scale 15s. 0d. per unit, lumpy, 75 per cent. Si, £62 10s. 0d. to £66 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 14s.1d. per lb. of Mo

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 11d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 11d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £80 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr.; 0.10 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.06 per cent. C,* 1s. 10½d. to 2s. 1d. per lb. Cr. * Average 68-70 per cent.

Metallic Chromium.—98/99 per cent., 6s. 9d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent. Cb + Ta, 19s. 0d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £58 10s. 0d.

SEMI-FINISHED STEEL

*** Re-rolling Billets, Blooms, and Slabs.**—BASIC: Soft u.t.s. 100 tons and over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons and over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C; £40 11s. 0d.; silico-manganese, £43 4s. 0d.

*** Billets, Blooms, and Slabs for Forging and for Stamping** 50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

FINISHED STEEL

*** Heavy Plates and Sections** (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

*** Small Bars, Sheets, etc.**—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £67 16s. 0d.; nickel-chrome, £100 18s. 0d.; nickel-chrome-molybdenum, £113 11s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £226 15s. 0d. to £227 0s. 0d.; three months, £228 10s. 0d. to £228 15s. 0d.; settlement, £227 0s. 0d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 2½d. per lb. rods, 238s. 6d. per cwt. basis; 20 s.w.g., 284s. 0d. per cwt.

Tin.—Cash, £941 10s. 0d. to £942 0s. 0d.; three months £954 0s. 0d. to £955 0s. 0d.; settlement, £942 0s. 0d.

Lead (Refined Pig).—First half October, £63 5s. 0d to £63 10s. 0d.; first half January £65 0s. 0d. to £65 5s. 0d. settlement, £63 10s. 0d.

Zinc.—First half October, £73 10s. 0d. to £73 12s. 6d.; first half January, £73 12s. 6d. to £73 15s. 0d.; settlement, £73 12s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £109 10s. 0d.; rolled zinc (boiler plates), all English destinations, £107 5s. 0d.; zinc oxide (Red Seal); d/d buyers' premises, £90 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes 1s. 9½d. per lb.; sheets to 10 w.g., 194s. 6d. per cwt.; wire, 2s. 7½d.; rolled metal, 194s. 6d. per cwt.

Brass (Brazing).—BS1400, SCB2, £172; SCB3, £169.

Brass (High Tensile).—BS1400, HTB1, £190; HTB2 £210; HTB3, £226.

Gunmetal.—BS1400, LG2, £209; LG3, £219; G1, 1½% £280; G1 ½% £294

Phosphor Bronze.—BS1400, PB1 (AID released), £311; PB4 £297 BS1400, 90/10/1, £298.

Leaded Phosphor Bronze.—BS1400, LPB1, £234.

Phosphor Bronze Strip, etc.—Strip, 295s. 3d. per cwt.; wire, 4s. 1½d. per lb.; rods, 3s. 4½d.; tubes, 3s. 4½d.; chill cast bars, solids 3s. 5d.; cored, 3s. 6d. (CHARLES CLIFFORD LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 11½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £230 0s. 0d. Quicksilver, ex-warehouse, £62 0s. 0d. Nickel, £660 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £236; AB2, £244.

Translation Services

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4, Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

BISI 2087 RESULTS OBTAINED WITH THE QUANTOVAC IN THE ANALYSIS OF STEELS. (From French.) Barry, W. H., and J. M. Carrol. *Rev. Univ. Mines*, 1959, *15*, May, 281-289. (£6.) Pig-iron can be analyzed for S, P, Mn, Si, Ni, Cr and Cu with a single excitation of the sample, using a graphite counter-electrode and a high voltage spark excitation. (Author's summary.)

BISI 2224 ABSORPTION AND EVOLUTION OF HYDROGEN IN IRON AT HIGH TEMPERATURES. Pihlstrand, F. *Jernkont. Ann.*, 1937, *121* (5), 219-231. (£3.) (From Swedish.) Under conditions similar to those employed by Sieverts and others, a rapid absorption and evolution of hydrogen in iron has been noted by the author. The addition of 1 per cent. of carbon or 1 per cent. of manganese does not effect the solubility, which is, however, perceptibly decreased in the presence of 4 per cent. of silicon. An account is given of processes by which hydrogen is lost. (*JISI* abstract 1937 (II), 196a.)

New translations in course of preparation include:—

BISI 2387 NITRIDING BY INDUCTIVE HEATING IN AQUEOUS AMMONIA. (From German.) Palme, R., and W. Track. *Härterei-Technik und Wärmebehandlung*, 1961, 7, Mar., 20-27.

BISI 2415 CONTRIBUTION TO THE QUESTION OF GRAIN-SIZE BEHAVIOUR IN STEEL. (From German.) Legat, A., *et al. Radex Rund.*, 1961, Aug., 657-663.

BISI 2428 POSSIBILITIES OF EXACT CRACK-DEPTH MEASUREMENT. (From German.) Matting, A., and V. Deutsch. *Materialprüfung*, 1961, *81*, June 20, 218-224.

The British Iron and Steel Translation Service requires a translation of the following article:—

E 2416 EFFECT OF STEEL SCRAP IN THE MIXTURE FOR MELTING IRON IN THE CUPOLA. (From German.) Siepmann, H., *et al. Giesserei*, 1960, *47*, Nov. 3, 608-14. The proportion of steel scrap to pig-iron in the mixture for melting in the cupola is discussed from the point of view of economic conditions and technical effects. Statistical evaluation shows that the composition of the mixture is decided mainly by current prices of the raw materials. Critical review of published information shows that claims for an advantage in using high-proportions of steel scrap cannot be substantiated, particularly in the hot-blast cupola with basic lining. The effect of composition of the mixture on the quality of cast irons still involves a number of uncertainties. (37 refs.)

Readers are asked to state whether they (*a*) are able to prepare a translation; (*b*) wish to buy copies if available; (*c*) will share half the cost of translation if there are only two requests, or (*d*) whether a translation already exists.

National Trades Technical Societies

Under the auspices of the National Trades Technical Societies, a lecture is being given this evening (October 5) on "Plastic and Fibre-glass Patternmaking" to South Staffordshire members, by a representative of Wilkinson, Limited, patternmakers of Bilston. The meeting is being held in the canteen of Bradley & Foster, Limited, Darlaston, and will be followed on October 12 by a visit to the works of Wilkinson, Limited. This meeting follows one on a similar subject, "Plastic Patternmaking," presented to the Derby section on Wednesday, October 4, and given at the Parker Foundry Company, Limited, by a representative of Leicester, Lovell & Company, Limited.

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E

American Letter

Gray Iron Founders' Society Meeting

Mr. H. Morrogh, director of the British Cast Iron Research Association, Birmingham, will be the main speaker at the 33rd annual meeting of the Gray Iron Founders' Society to be held in Toronto from October 18 to 20. Mr. Morrogh's paper will be in two parts entitled "What BCIRA is and How it Works" and "Current and Recent Grey-iron Research Activities of the BCIRA." Mr. Morrogh will also speak on the Friday afternoon when he will discuss spheroidal-graphite iron, this session being presided over by Mr. J. W. Perry, chairman of the GIFS ductile-iron committee. In addition to Mr. Morrogh's paper, other technical contributions to be presented on the Thursday will be made by Mr. A. M. Slichter, president of the Pelton Steel Castings Company, Milwaukee, on "What Research has done For Us"; by Mr. H. P. Steele, manager of Government relations service for the General Electric Company of New York City on "The Business and Politic Climate We live in," and by Mr. C. C. Williams, Jr., GIFS legal counsel and member of Jones, Day, Cockley & Reavis. The meeting on Friday will also include three new GIFS educational films, "Straight Line to Production," "Coating Design and Analysis," and "Cost Saving Design Shortcuts."

Foundrymen Criticized for Poor Quality-control

The US foundry industry has been taken to task by a university professor for failing to keep the standards of its product up to par. Mr. H. F. Taylor, professor of mechanical metallurgy, Massachusetts Institute of Technology, complained to the American Foundrymen's Society about the uncertainty of foundries to control the quality of metal castings. Speaking at the East Coast regional conference of the Society, held on September 22 and 23 in New York City, Professor Taylor said that until every foundry has quality control in metal casting, he seriously doubted if the foundry industry can lay claim to the large tonnages it has lost to competitive wrought and welded components over recent years. He suggested that some system of industry control be provided over the producer of shoddy castings, or specifications prepared to control the selling of sub-par castings. He recommended that purchasers of castings for strategic applications qualify a foundry or foundries for producing their needs and also apply rigid and high specifications. Other points made by Professor Taylor was a need to support basic research if the foundry industry wanted to see "a foundry in its future" and a need for foundries to meet delivery dates or they will continue to lose to other foundries and to competitive methods of metal forming.

Survey of US Foundry Industry

Surveying the present position of the US foundry industry, the American journal *Foundry* reports that the grey-iron foundries showed the largest decrease in numbers during the last two years with a drop of 156, and that the 2,200 grey-iron foundries in operation to-day compare with 3,000 ten years ago and 3,300 twenty years ago. With the exception of an increase of 60 s.-g. iron foundries to 271 and an increase of 16 producers of zinc-base castings to a total of 984, American foundries making all other types of metals have reduced in number as compared with two years ago.

Turning to foundry equipment, the report states that the number of cupolas in operation decreased to 3,057 compared with 4,575 ten years ago and with approximately 5,000 in 1941. The US foundry industry now has a total of 3,140 arc and induction furnaces, an increase of 260 since two years ago and to be compared with fewer than 1,000 in use in 1941. The number of open-hearth furnaces in service total 110, compared with 257 twenty years ago. Crucible furnaces continue to be the leading type of melting unit employed, with 14,231 in use—an increase of 4,600 during the last twenty years.

The American foundry industry continues to be dominated by small plants, three-quarters of the 5,879 foundries in the US and Canada employing fewer than 50 persons; only 28 having more than 1,000 employees and twenty of these being grey-iron foundries. Other data included in the survey show that there are at present 1,342 laboratories, 2,814 patternshops, 2,868 machine-shops, 2,339 welding departments, and that more than 1,400 foundries carry out heat-treatment and 1,461 operate tool and die shops.

Buckley & Taylor's Centenary

This year, Buckley & Taylor, Limited, Castle Iron Works, Oldham, Lancs.—a member of the Brightside group of companies—celebrates its centenary. In celebration, the company is holding "Open Days" (September 25 to October 6) so that customers, representatives from technical colleges, universities and the Press, as well as employees and their families, may be shown round the works. The Mayor of Oldham, Alderman Alice Kenyon, visited the works on the evening of Friday, September 29, when a special "Open Evening" was held for employees and their families, and she was officially welcomed by Mr. T. C. Firth, chairman of the Brightside group of companies.

Buckley & Taylor was established over 100 years ago as a foundry and general-engineering business. In 1947, the company became part of the Brightside group and, to make way for further expansions of the heat-exchange and general-engineering sides of the business, the foundry activities were later transferred to the group foundries at Sheffield. Buckley & Taylor are manufacturers of heat-exchanges, distillation plants, high-speed flywheels, steelworks rolling mills and auxiliary plant, and the centenary of the firm coincides with the introduction of three entirely new designs of water-distillation plants.

BS for Crown Bottle Openers

Crown bottle openers, often in cast form, are frequently distributed free for advertisement purposes, and there is obviously a desire for novel designs. In practice most openers are quite satisfactory, but there have been occasional instances of inefficient and dangerous openers. The British Standards Institution has therefore published a standard (BS 3414) which avoids any restriction on design but specifies those features that are essential to ensure safety and efficiency of both hand and bar openers. Even so, care when using an opener is very important. The Committee which prepared the standard emphasizes the fact that there is often a loss of efficiency as a result of wear and tear. Many breweries arrange for periodical inspection of bar openers, and if necessary replace them. The Committee strongly recommends this procedure. (Copies of the Standard may be obtained from the British Standards Institution, sales branch, 2 Park Street, London, W.1, price 3s. each, postage extra to non-subscribers).

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News in Brief

ALLIED IRONFOUNDERS, LIMITED, have disposed of their interest in Lundell (Great Britain), Limited, makers of agricultural machinery, to John Deere, a US manufacturer of farm equipment, some of whose products Lundell have produced under licence for many years.

MR. VALGARD BRIEM, head of the purchasing department of the Reykjavik Municipality of Iceland visited Sheffield and Doncaster on September 26. His programme included a visit to Ellis, Son and Parramore, Limited, surgical-appliance manufacturers, Spring Street works, Sheffield, and to Peglers, Limited, plumbers' and engineers' brassfounders, Belmont Works, Doncaster.

BRITISH WELDING RESEARCH ASSOCIATION (publications department) from Abington Hall, Abington, Cambridge have now issued an index to articles published in the 1960 issues of *Automatic Welding*, which is their cover-to-cover translation into English of the monthly Russian welding journal *Avtomaticheskaya Svarka* (sponsored by the Department of Scientific and Industrial Research).

A GOLD MEDAL at the California State Fair has been awarded to George Wostenholm & Son, Limited, of Sheffield, for a carving set made by the firm. Premier award was made for the Monte Carlo Carving Set. The award was given on the basis of 60 per cent. marks for good design, 20 per cent. functional value and 20 per cent. for practicability. The set is already a winner of an award this year by the Council of Industrial Design.

ENGLISH ELECTRIC COMPANY, Limited, have secured a £6,000,000 contract for an extension to the Cairo South power-station, which will make it one of the biggest in the Middle East. Two 60,000 kw. steam turbines for the work will be made at Rugby; alternators, transformers and switchgear at Stafford; and low-volted switchgear and fusegear at Liverpool. The order was gained in the face of competition from Czechoslovakia, France, Germany and the United States. Part of the payment will be in cotton.

A TEAM OF HIGHLY-SKILLED MEN is being formed at the new Hamilton, Lanarkshire, factory of Rolls-Royce, Limited, to further development of the turbo-jet engine, which powers Britain's Comet and France's Caravelle air liners, with the objective of keeping it to the forefront in aero-engine competition. Rolls-Royce, which employs 40,000 people in its aero-engine division, 12,000 of them in Scotland, has, since the end of the second world war to the middle of this year, exported £265,000,000 worth of aero engines and spares.

THE BOROUGH OF WIDNES have accepted the tender of Dorman Long (Bridge & Engineering), Limited, amounting to £139,000 for demolition of Widnes Transporter Bridge which crosses the River Mersey and the Manchester Ship Canal. The bridge was built in 1905 and consists of approximately 3,000 tons of steel and iron. It has been replaced by the new Runcorn-Widnes Bridge which was built by Dorman Long and opened on July 21, 1961, by H.R.H. Princess Alexandra of Kent. Demolition of the old bridge is scheduled to be completed in two years.

A VETERAN STEAM LOCOMOTIVE was "drummed out" of the Sherwood Foresters at a ceremony at Derby attended by the regimental band and the ram mascot on Saturday, September 23. The steam locomotive No. 16112, which has borne the regimental crest and name plates of the regiment since it was built in 1927, is being retired, and the crest transferred to a new 90-miles-an-hour diesel locomotive No. D100. The engine is used on the "Robin Hood" express from Nottingham to London. Major General C. B. Fairbanks, colonel of the regiment, unveiled the crest on the new diesel and then drove a short distance alongside the No. 1 platform at Derby's Midland Station.

BUSINESS CONCLUDED by the foreign trade organizations of the German Democratic Republic at the Leipzig Autumn Fair (September 3 to 10) amounted to 2,923,000,000 marks, of which 2,145,000,000 marks was accounted for by trade with socialist countries and 778,000,000 marks by trade with others. Exports orders booked amounted to 1,815,000,000 marks, orders to the value of 652,000,000 marks being received from Western Europe and overseas. Purchases by the German Democratic Republic totalled 1,108,000,000 marks, of which 982,000,000 marks was the value of orders placed to the socialist countries and 126,000,000 marks the value of orders placed elsewhere. The Fair attracted 6,439 exhibitors and 201,475 visitors.

OVERSEAS SALES REPRESENTATIVES of Henry Wiggin & Company, Limited, from 13 countries, came to the UK last week, at the company's invitation, to inspect their new works at Holmer Road, Hereford. The plant which represents the culmination of the company's modernization plan, scheduled for completion in 1965, will comprise, when completed, 25 acres of buildings on a total site area of 52 acres. In addition to a tour of the plant and laboratories, the visitors also saw an exhibition of corrosion-resistant materials which had been specially arranged for their visit. For the past 40 years the company has been exporting nickel and nickel-alloy products to most of the countries in the world, and this visit of the representatives was yet another feature of their export drive.

THE EXTENSIVE EXPANSION and reconstruction which has taken place, and is continuing, at the works of Samuel Fox & Company, Limited, Stocksbridge, means that the firm is better equipped to deal with the demand for steel which will exist when the present-day recession is passed, said Mr. R. Swinden, works manager (services), when he welcomed 570 retired employees and their wives at the Stocksbridge Works Social Services Club annual reunion tea and concert on September 23. He said that at their last gathering, the company was just about to spend a great deal of money on major developments at the works, and many would have seen visible evidence of what had taken place. Several new buildings had been put up, and development had begun on the Sheephouse Wood area which would be the new home for their long-established business in wire.

A "MADE IN SHEFFIELD" exhibition of labels was held at the Grand Hotel, Sheffield, on September 20 and 21. Organized by Tickopres, Limited, specialists in self-adhesive labels and labelling machines, the labels dated as far back as 1840. Firms had been asked to lend some of their more interesting labels and the response was so good that Mr. John Briggs, joint managing director of Tickopres, has suggested that Sheffield city museum should have a permanent label section. One of the largest labels on display was a 10¾ sq. in. label for Arthur Balfour & Company, Limited, and the smallest was three-sixteenths of an inch square, used by a Dronfield electronics firm. Also exhibited were some firm's Guard Books, showing details of label orders. The firm organized the exhibition in Sheffield first as most of the firms use "Made in Sheffield" tags rather than "Made in England."

Electrical Aids in Industry—Data Sheet **20**

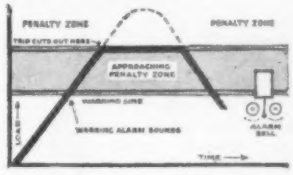
Load Factor Improvement

Most industrial electricity tariffs consist of a fixed charge based on the maximum demand for electricity by the works and a running charge for each unit (kWh) of electricity used. Broadly speaking, the fixed charge covers the capital cost of generating, transmitting and distributing equipment for the particular demand and the running charge covers the cost of generating the units.

Thus, if the factory maximum demand is reduced for the same level of consumption or is held constant for an increased consumption, the cost per unit will be reduced. This is termed improving the 'load factor': load factor being defined as the ratio of the number of units supplied during a given period to the number of units that would have been supplied had the maximum demand been maintained throughout the period; it is usually expressed as a percentage. Some ways in which load factor can be improved are:

CONTROL OF MAXIMUM DEMAND

A maximum-demand alarm gives a warning when the maximum demand is about to be exceeded. One of the simplest devices has two warning contacts, but, as a useful addition, an auxiliary relay can be supplied so that non-essential load can be tripped automatically.



The Load Limiter, an automatic device, meets the requirements of medium and large consumers who wish not only to control their system loading to some target maximum but also to improve the load factor in order to increase the overall economy of the plant.

EXAMPLES OF REDUCTION IN MAXIMUM DEMAND

Broadly speaking, loads which contain some storage element can be transferred from on-peak to off-peak times. Examples are: charging electric batteries used in industrial trucks and road vehicles; pumping loads in drainage schemes; water pumping in quarries, gravel pits and other open-air workings; large cold-storage warehouses; ice-making factories in which cost of power is a sufficiently large item of the operating expense to make a reduced charge acceptable.

Many processes at times of peak demand can, under controlled conditions, tolerate a temporary reduction, or even cessation, of supply without any serious effect on the product. With electrochemical processes such as in the manufacture of hydrogen peroxide no difficulty arises from periodic interruptions at short or even no notice.

In a plastics factory the management arranged for dies to be switched on by time switches one after another early Monday morning so at the beginning of work all dies had reached their operating temperatures.

In a certain chemical works compressed air is used for blowing out containers for plastic material. The nature of this operation is such that the consumption of air is spasmodic and irregular. The demand-recording meter in this works showed that the 18 kW motor driving the air compressor was frequently cutting in on top of the factory load, thus incurring a higher maximum-demand charge. In this case all that was necessary was to ensure that the air receiver only required charging at night-time or at other off-peak times. It was found that the existing receiver had such a small capacity that the pump had to operate to recharge it almost every time the blowing operation took place. This small receiver was therefore replaced by a receiver of large enough capacity to maintain the blowing requirements over the peak periods without further charging.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books are available on electricity and productivity (8/6 each, or 9/- post free)—'Higher Industrial Production with Electricity' is an example.

E.D.A. also have available on free loan in the U.K. a series of films on the industrial uses of electricity. Ask for a catalogue.

7926

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Company News

Bruce, Peebles/Belmos Merger

On behalf of Bruce, Peebles & Company, Limited, manufacturing electrical engineers, of Edinburgh, Hambros Bank, Limited, has made a share exchange offer for the capital of the Belmos Company, Limited, makers of colliery and industrial switchgear, of Bellshill (Lanarkshire). The offer is on the basis of one Bruce Peebles 6½ per cent. cumulative preference £1 shares for each Belmos 6 per cent. cumulative preference £1 share (£75,000) in issue and 11 Bruce Peebles 10s. ordinary shares for every two Belmos £1 ordinary shares (£248,924).

It is proposed that the existing Bruce Peebles 7½ per cent. cumulative participating preference be converted into 6½ per cent. cumulative preference and that a scrip issue of two new 6½ per cent. preference be made for every £3 of the 7½ per cent. preference.

In a letter to shareholders, Mr. Thomas Coughtrie, who is chairman of both companies, states that the business of both companies is complementary in regard to range of products and there has been built up over the years a "friendly and close" relationship between them. Diversification by Bruce, Peebles will be advanced considerably by the proposed amalgamation with a concern which has already undertaken a considerable degree of diversification in order to provide a service in the field of power engineering and control. A closer relationship between the various research activities of the two companies will lead not only to economy, but also to a more rapid development of new products, processes, and techniques, and a better deployment of sales effort.

The scheme has the full approval of the boards of both companies and Hambros Bank considers the proposals to be fair and reasonable.

DANIEL ADAMSON & COMPANY, LIMITED, engineers and boiler manufacturers, etc., of Dukinfield (Cheshire)—The company is not paying an interim dividend for 1961. Last year there was an interim of 3 per cent. and a final of 5 per cent.

HATTERSLEY (ORMSKIRK), LIMITED, engineers, iron and non-ferrous founders—Acceptances have been received in respect of 100 per cent. of the outstanding ordinary shares of Beck & Company (Meters), Limited, and the offer is declared unconditional.

S. E. OPPERMAN, LIMITED, engineers, gear cutters, etc., of Boreham Wood (Herts)—A cash offer of 3s. per 2s. share for the £311,183 capital has been received from the Export Tool Group, Limited, of London, W.1. Full acceptance would involve a payment of over £466,000. The offer is being considered.

CEMENTATION COMPANY, LIMITED—The company incurred a group net trading loss of £202,274 for the year to March 31, 1961, against a previous profit of £425,800, and there is no ordinary dividend, as before. Provisional results, considered to be a reliable guide, for the first five months of the current year, indicate a net profit of £150,000 after all charges, compared with the loss of £100,000 during the same period last year.

CROSSLEY BROS., LIMITED, manufacturers of diesel locomotives, marine and gas engines, of Manchester—Dividend at 5 per cent. for the year to April 30, 1961, is being maintained. Net profit is up to £19,506 (£14,811) after tax of £19,290 (£1,230). Net profit of Crossley Premier Engines, Limited, controlled by Crossley Bros., rose to £17,403 (£6,762), after tax of £15,700 (£6,000). Dividend is 15 per cent.

DOXFORD & SUNDERLAND SHIPBUILDING & ENGINEERING COMPANY, LIMITED—As forecast a final dividend of 10 per cent. is recommended on the increased capital. Profits of the Doxford group, before tax, fell from £1,248,318 to £819,361 for the year to end-June and those of the Sunderland Shipbuilding Dry Docks & Engineering Company, Limited, acquired under the June merger, from £1,017,761 to £796,365 for the year to March 31, 1961.

QUALCAST, LIMITED, light repetition ironfounders, etc., of Derby—The final dividend of 11 per cent. makes 18 per cent. for the year to June 30, 1961. The previous year's total was equal to 17 per cent., adjusting for a 50 per cent. scrip issue. Had it not been for the Chancellor's request, a higher dividend would have been recommended, the directors state. Group trading profit increased to £1,767,386 (£1,611,453) and the profit, before tax, is increased to £1,411,624 (£1,311,783).

BRITISH WAGON COMPANY, LIMITED—Announcing a maintained 5 per cent. interim dividend, the directors report that group profit for the first six months of the year compares closely with that for the similar period in the previous year. The directors find it difficult at this stage accurately to forecast the year's results, and the final dividend recommended will obviously depend on the outcome of the remainder of the year's trading. The final dividend last year was 7½ per cent.

CAPPER PASS & SON, LIMITED, smelters and refiners, of North Ferriby (Yorks)—Decline in group net profits from £202,463 to £176,280 in the year ended March 31, 1961, was due, states the chairman, Lord Fraser, to the long-standing custom of bearing the ups and downs in world metal prices instead of "hedging" them on the London market. A very extensive modernization and plant streamlining plan to reduce costs is now nearing completion and the scheme is to be embarked on with a view to completion within two or three years.

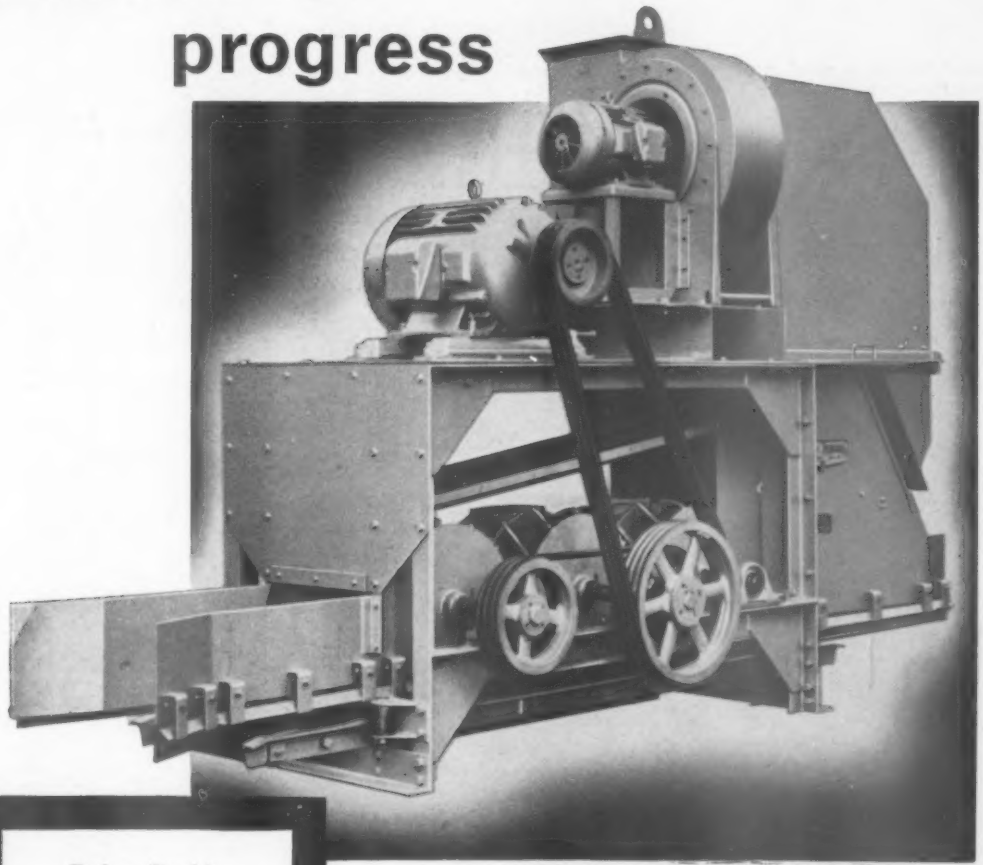
Ionizing Radiation Hazards

Six Orders* made by the Minister of Labour, Mr. John Hare, under the Ionising Radiations (Sealed Sources) Regulations, 1961, will come into force on February 1, 1962. They prescribe details to be kept of maximum permissible radiation doses and of doses received by each worker designated as a "classified worker" under the Regulations, of medical examinations of such workers, and of tests of instruments used to check radiation levels. The method of testing a sealed source for leakage is stipulated and the level of leakage is laid down at which such a source must be taken out of use until it has been repaired.

The form of the record, which an employer must give to a worker leaving his employment is laid down, as are the particulars which are to be included in certificates of results of examination of photographic films worn by workers to measure any exposure to ionizing radiations. Forms, including explanatory notes, will be available later in the year for recording the particulars kept under the Orders. They will be on sale from H.M. Stationery Office or through any bookseller.

* The Ionising Radiations (Sealed Sources) (Radiation Dosemeter and Dose Rate Meter) Order, 1961, S.I. 1961, No. 1,710; Leakage Test Order, 1961, S.I. 1961, No. 1,711; Laboratory Certificate Order, 1961, S.I. No. 1,712; Radiation Dose Record Order, 1961, S.I. 1961, No. 1,713; Health Register Order, 1961, S.I. No. 1,714; Transfer Record Order, 1961, S.I. No. 1,715; obtainable from H.M. Stationery Office, or through any bookseller; price 3d. net

pattern for progress



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The PEKAY aerator/coolerator

* Continuously processes and conditions foundry sand * Fits flat, troughed, horizontal or inclined rubber belt conveyors. * Specially designed undercarriage does not increase wear or tension on belt. * Cheaply and quickly installed. One of the range 10 tons to 450 tons. 18″ to 48″ wide belts. * Increases output and improves quality from existing mixing plant.

Write for further details of Baker Perkins Pekay Aerators/Coolerators to :

BAKER PERKINS LTD., ENGINEERS,
Foundry Machinery Department, Bedewell Division, Hebburn-on-Tyne, Co. Durham. Tel. Jarrow 897124

B.P.F. 14

Pig-iron and Steel Production

Statistical Summary of July, 1961 Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table 1 summarizes activities during recent months. Table 2 gives production of steel ingots and castings in July. Table 3, weekly average production of finished steel in June. Table 4 gives the production of pig-iron and ferro-alloys in July, and furnaces in blast. (All figures are weekly averages in thousands of tons).

TABLE 1.—*Iron and Steel Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imported ore used.	Coke sent to blast furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	Iron and steel.	Coal.[1]	Basic materials[2]						Imports.[3]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[4]
1959	340	496	477	286	244	210	242	208	7	388	291	2,244
1960	339	505	482	329	319	264	303	243	24	467	361	2,702
1961—April ..	339	538	462	313	322	261	308	244	6	472	355	2,745
May[5] ..	340	520	484	333	304	254	300	244	5	466	343	2,754
June ..	341	520	479	326	298	249	297	233	5	447	349	2,679
July ..	342	520	477	312	270	238	277	196	7	380	310	2,598

TABLE 2.—*Average Weekly Production of Steel Ingots and Castings in July.*

District.	Open-hearth.		Bessemer and L.D.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derbys, Leics, Notts, Northants, and Essex ..	—	4.4	14.8 (basic)	2.5	0.1	20.4	1.4	21.8
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches	1.5	30.8	—	4.7	0.4	36.1	1.3	36.1
Yorkshire (excl. N.-E. Coast and Sheffield) ..								1.3
Lincolnshire	—	40.5	—	—	0.1	40.5	0.1	40.6
North-East Coast	0.9	73.0	—	1.8	0.4	74.0	2.1	76.1
Scotland	0.4	16.5	—	2.0	—	17.5	1.4	18.9
Staffs, Shrops, Worcs, and Warwicks	—	23.6	—	4.3	0.7	26.7	1.9	28.6
South Wales and Monmouthshire	1.4	71.0	20.4 (basic)	0.7	0.1	93.2	0.4	93.6
Sheffield (incl. small tonnage in Manchester) ..	8.3	33.9	—	14.3	0.3	54.9	1.9	56.8
North-West Coast	0.1	—	5.4 (acid)	0.9	—	6.2	0.2	6.4
Total	12.6	293.7	40.6	31.2	2.1	369.5	10.7	380.2
June, 1961	14.2	357.1	39.4	34.7	2.1	435.4	12.1	447.5
July, 1960	9.6	317.6	36.7	25.7	1.8	382.6	8.8	391.4

TABLE 3.—*Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1959.	1960.	1960.	1961.	
			June.[5]	May.[5]	June.
Non-alloy steel:					
Ingots, blooms, billets, and slabs[6]	5·1	5·6	5·2	7·3	7·2
Heavy rails ..	6·8	8·7	8·4	8·0	9·2
Sleepers	0·6	0·8	0·6	1·3	0·7
Fish and soleplates	0·4	0·6	0·5	0·9	0·7
Plates, 3 mm. thick and over:	43·1	52·9	50·6	61·9	58·2
Other heavy prods.	41·2	53·1	53·1	52·6	53·0
Ferro-concrete bars	9·6	12·0	12·6	15·0	13·9
Wire rods	23·5	28·6	29·1	28·0	27·5
Arches, etc. ..	7·8	7·9	8·4	8·0	7·8
Other light sections	33·0	41·3	40·7	38·0	37·8
Bright steel bars ..	7·6	9·7	9·5	9·0	9·6
Hot-rolled strip ..	27·4	33·1	33·8	28·6	29·5
Cold-rolled strip ..	8·0	10·0	9·9	9·3	9·1
Sheets, incl. coated	47·0	53·5	52·3	49·3	50·2
Tinplate	20·9	22·4	22·4	19·3	21·1
Blackplate ..	0·7	0·9	0·9	0·6	0·7
Tubes up to 16 in. ..	20·6	23·8	24·6	21·8	24·3
Tube fittings, etc. ..	0·4	0·4	0·4	0·4	0·4
Tyres, wheels, axles	2·4	2·4	2·2	1·9	2·3
Forgings (excl. drop)	2·1	2·2	2·1	2·2	2·4
Steel castings ..	3·6	4·3	4·2	4·5	5·0
Tool steel	0·2	0·2	0·2	0·2	0·3
Total	312·0	374·4	371·7	367·5	370·9
Alloy steel	18·2	22·5	21·7	22·3	25·1
Total UK deliveries[7]	330·2	396·9	393·4	389·8	396·0
Add: Imported finished steel ..	7·1	19·1	29·4	3·5	5·0
	337·3	416·0	422·8	393·3	401·0
Deduct: Intra-industry conversion[8] ..	47·6	56·4	57·3	51·7	53·3
Total new material ..	289·7	359·6	365·5	341·6	47·73

TABLE 4.—*Production of Pig-iron and Ferro-alloys.*

District.	Furnaces in blast.	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.
Derbys, Leics, Notts, Northants, and Essex	20	—	27.2	18.8	—	46.0
Lancs (excl. N.-W. Coast), Denbighs, Flints, and Ches ..	8	—	21.1	—	2.2	23.3
Lincolnshire	10	—	42.4	—	—	42.4
North-East Coast ..	15	2.3	52.7	—	—	55.0
Scotland	6	0.1	16.3	1.2	—	17.6
Staffs, Shrops, Worcs, and Warwicks ..	5	—	9.0	1.0	—	10.0
South Wales and Mon	11	0.6	61.6	—	—	62.2
Sheffield	2	—	2.9	—	—	2.9
North-West Coast ..	6	16.5	—	0.7	—	17.2
Total	83	19.5	233.2	21.7	2.2	276.6
June, 1961	86	24.4	247.7	23.0	2.3	297.4
July, 1960	84	23.0	237.5	24.3	4.1	288.9

[1] The index for coal is now based on prices ruling on the last day of each month.

[2] Used in non-food manufacturing industries.

[3] Weekly average of calendar month.

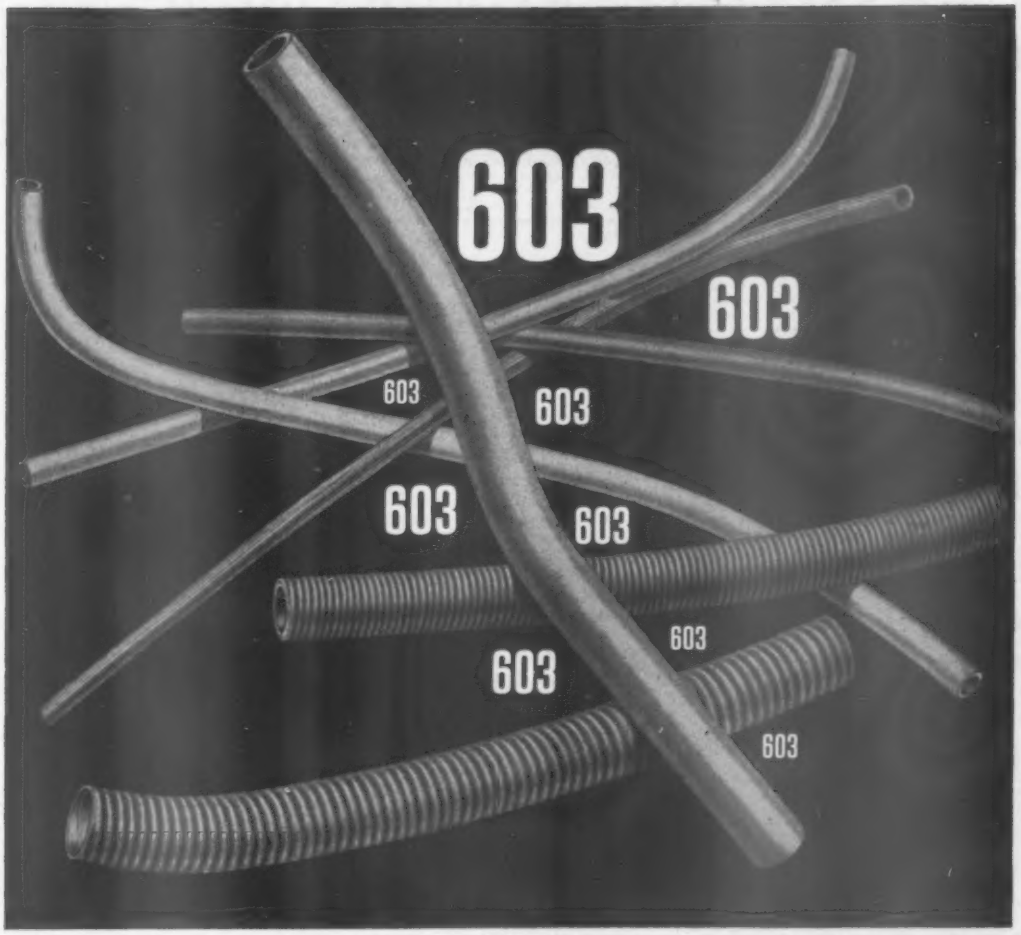
[4] Stocks, mainly ingots and semi-finished, at the end of the year and months shown.

[5] Five weeks, all tables.

[6] Other than for conversion into any other form of finished steel listed.

[7] Includes finished steel produced in the UK from imported ingots and semi-finished steel.

[8] Material for conversion into other products also listed in this table.



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PREPAID RATES: **Twenty words for 10/- (minimum charge) and 4d. per word thereafter. Box numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

YOUNG FOUNDRYMAN, 24 years old, seeks progressive position. Advanced certificates in pattern making and foundry practice. Box YF976, FOUNDRY TRADE JOURNAL.

YOUNG MAN—live wire—wants more lucrative position. Now earning £1,800 p.a. as Foundry Director. A.I.M., M.I.B.F. Box YM962, FOUNDRY TRADE JOURNAL.

METALLURGIST (41) desires executive position with small foundry. Twenty-four years' practical and technical experience in iron foundry management. Box MF922, FOUNDRY TRADE JOURNAL.

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FOUNDRY TECHNICIAN, Midlands, seeks position as Sales or Demonstration Representative for foundry equipment or supplies. Any territory considered. Box FT989, FOUNDRY TRADE JOURNAL.

ALUMINIUM DIE CASTS.—FOUNDRY ENGINEER, A.M.I.B.F., 25 years' practical experience in gravity die castings, centrifugal casting, die design and manufacture, shell mould core making, some knowledge of pressure die casting, seeks change to smaller company where expansion is possible. B'ham area preferred. Box AD975, FOUNDRY TRADE JOURNAL.

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wish to appoint a

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for their Iron Foundries. The unit concerned employs 400 and has a capacity of 14 thousand tons of castings per annum in weights up to 25 tons and in alloys and special irons as well as standard foundry irons. Production is by mechanised plant and machines as well as by floor moulding in dry sand, green sand and loam. The foundries serve the Engineering, Steel, Chemicals, Gas and Electrical industries and also the domestic market.

This position, which offers a splendid opportunity to a man of the right calibre, is superannuated and assistance with housing is available.

Applications, which will be treated in the strictest confidence, should be made on the Company's official application form which may be obtained from the

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FOUNDRY SUPERINTENDENT

Applications are invited from men between the ages of 35 and 45 for the position of **FOUNDRY SUPERINTENDENT** in a grey iron foundry in the North East.

The foundry produces up to 150 tons of miscellaneous castings per week in all grades of cast iron including S.G. iron.

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FOUNDRY FOREMAN required for grey iron foundry using green sand and CO$_2$ process for producing plate and cored castings up to 10 cwt. Good prospects for young man with practical experience and good technical background. Preference given to applicant possessing National Foundry College Diploma. Apply PERSONNEL OFFICER, Thomas Potterton Limited (Member of the De La Rue Group), Emscote Road, Warwick.

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now in process of mechanisation requires a

FOREMAN

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FOUNDRY FLOOR FOREMAN

Required for grey iron foundry using green sand and CO_2 process for producing plate and cored castings up to 10 cwt.
Good prospects for young man with practical experience and good technical background.
Preference given to applicant possessing National Foundry College Diploma.

Apply Personnel Officer
THOMAS POTTERTON LIMITED,
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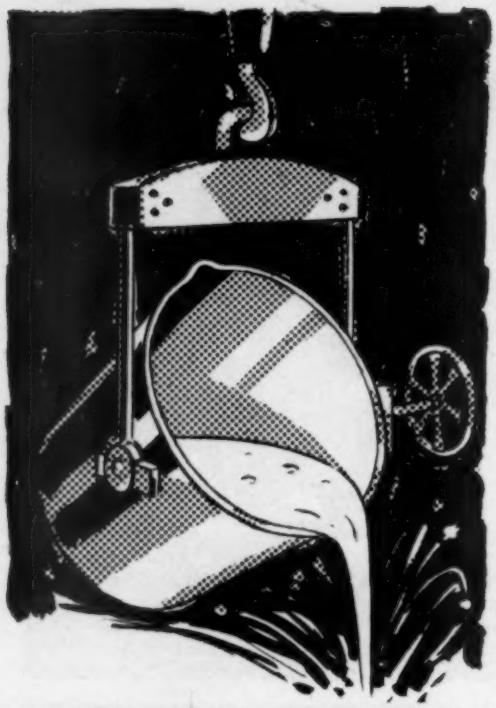

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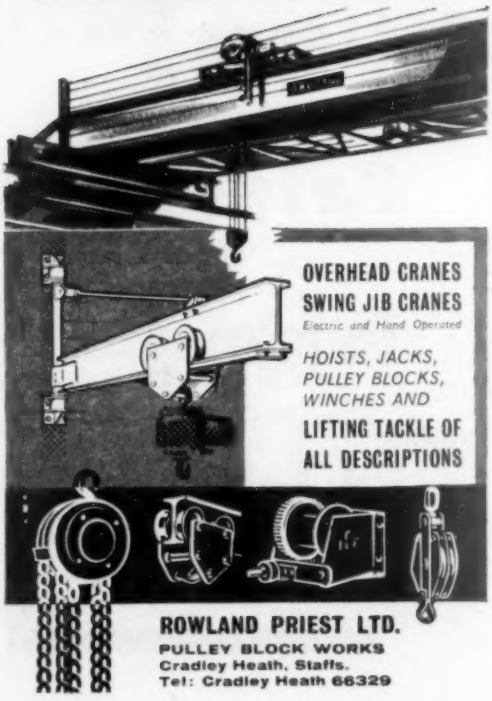

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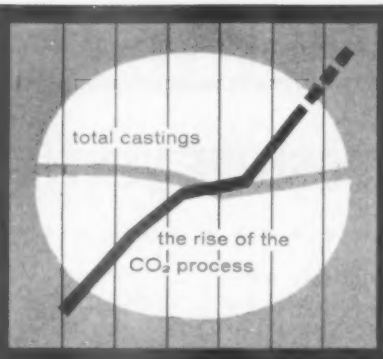

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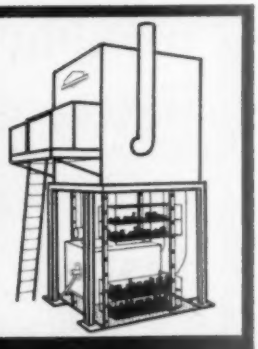

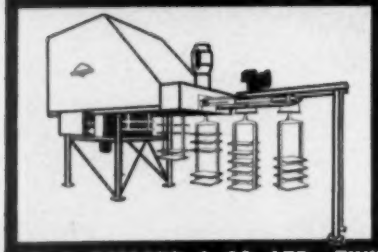

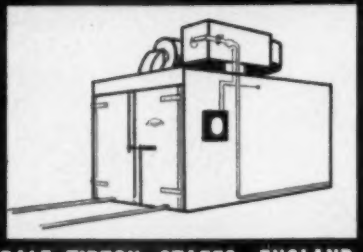

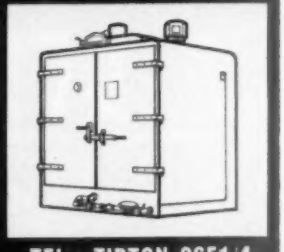

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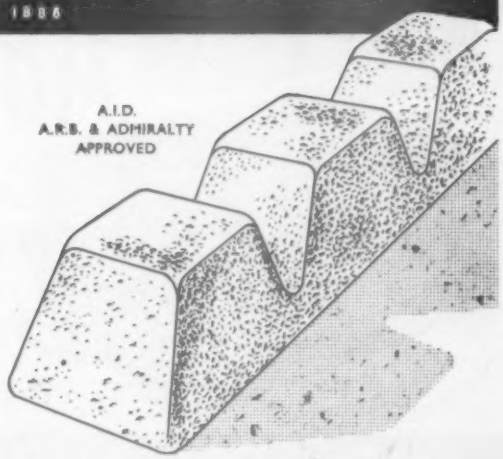

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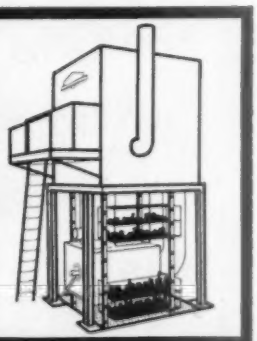

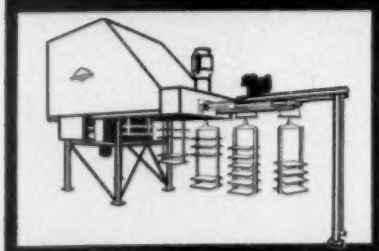

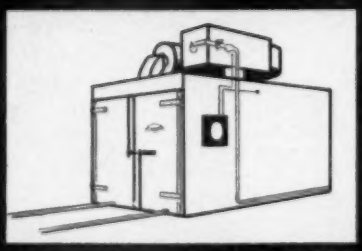

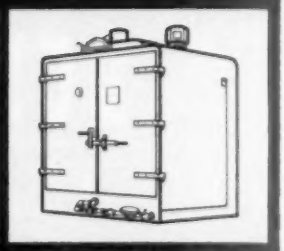

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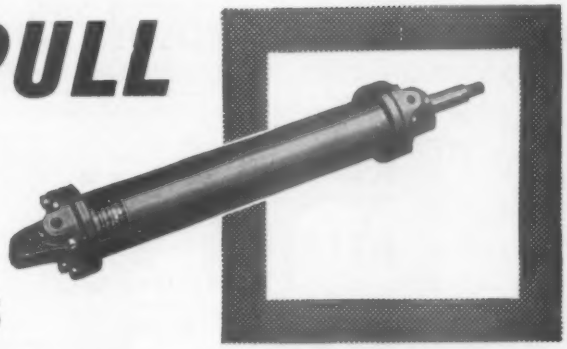

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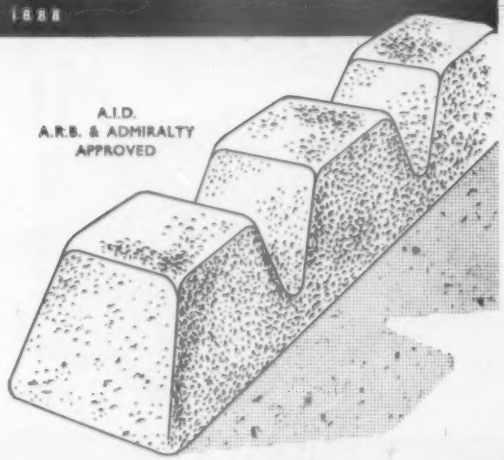

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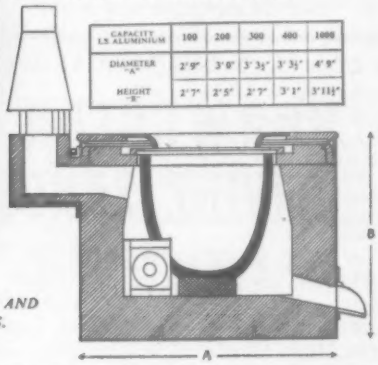

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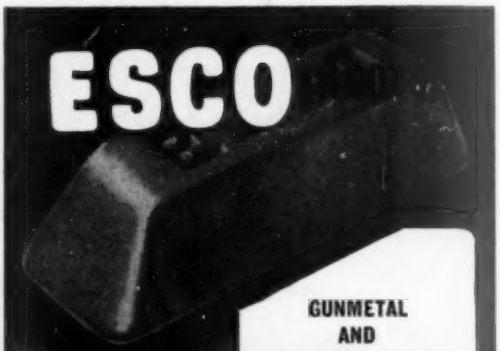
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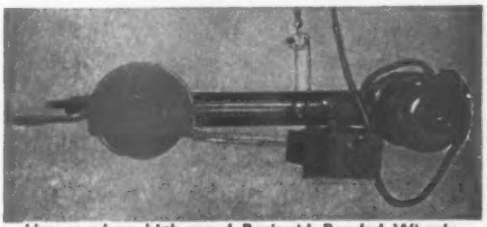

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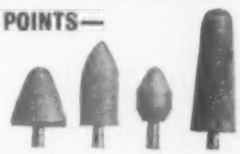

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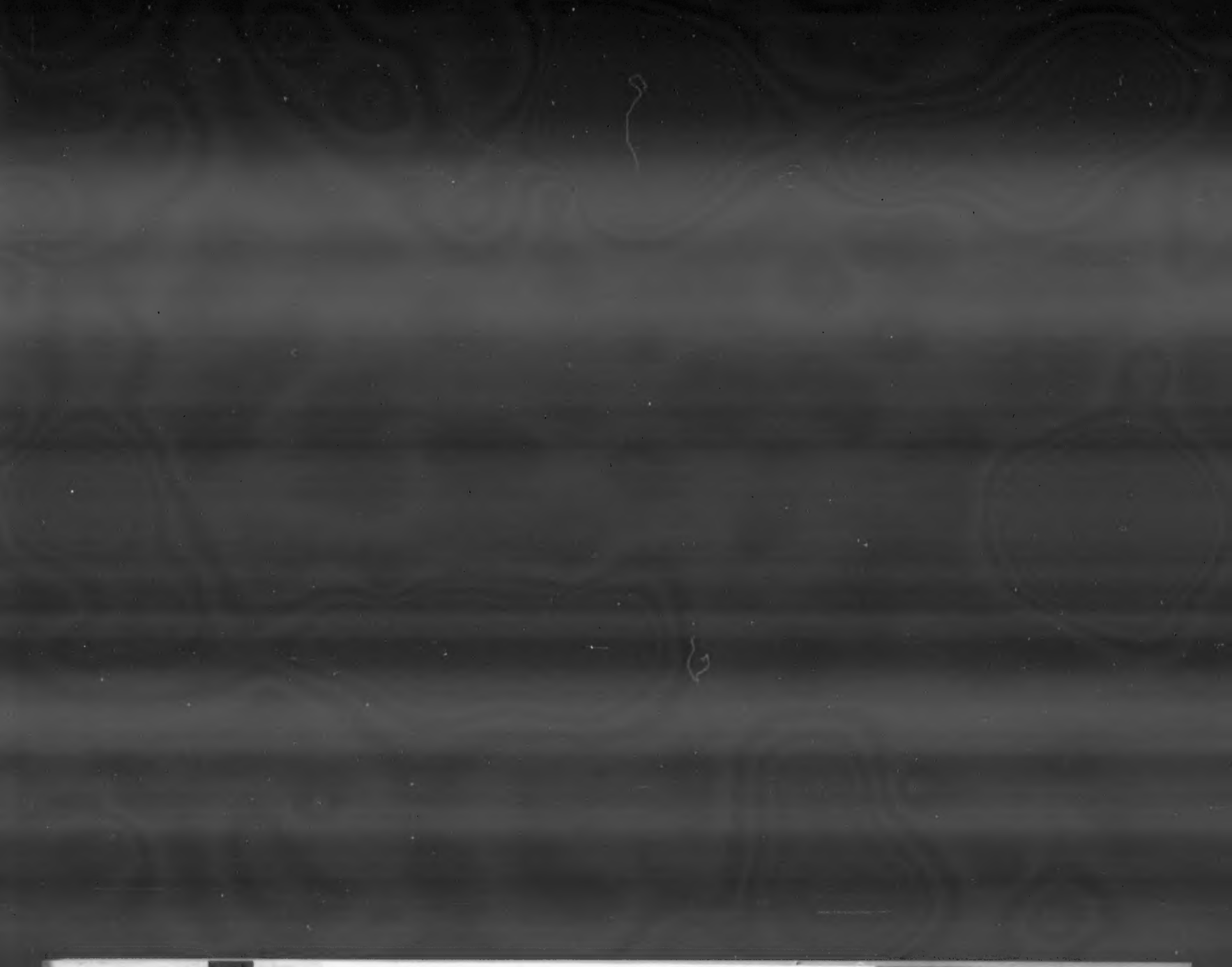
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